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Fixtures Used to Build Frames for Noiseless Typewriters

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Making the typewriter frame — Simple jigs and fixtures used—Some interesting automatic devices—Milling a 168-tooth rack in one pass

THE No. 6 Noiseless typewriter recently put on the market by the Remington Noiseless Typewriter Corporation and built at its Middletown, Conn., plant, is different in many respects besides its noiselessness from other machines of its class; and not the least of these differences lies in the fact that the frame, instead of being cast in one piece and requiring a multitude of elaborate and costly fixtures in which to machine it, is made up of simple parts that can be produced in correspondingly simple and inexpensive tools.

In Fig. 1 is shown a frame in the assembling fixture as the last screw is being driven, and beside it to the left on the bench are the six parts of which it is composed: The lower member of the fixture, not visible in the picture, is bolted to the bench and upon it swivels the rectangular plate *A* to which all the locating lugs and clamps are affixed. This top plate is rotatable and may be held in either of two positions by a spring latch, so that the assembler can reach all the screws of the frame handily.

Fig. 1—Assembling the frame

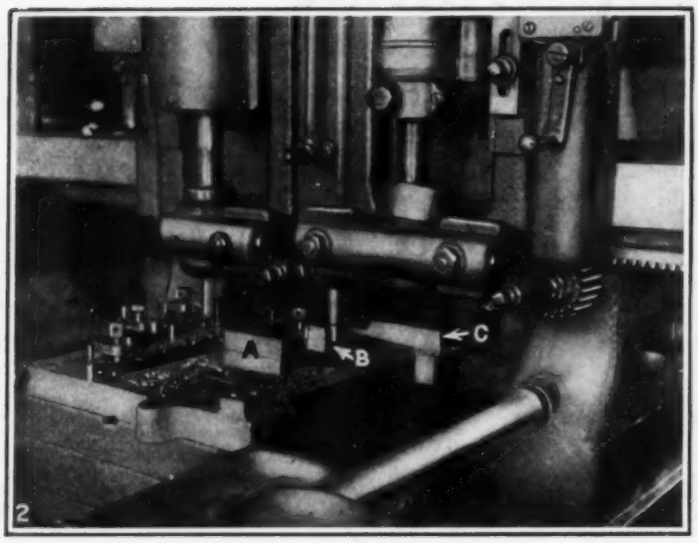
The assembler sets the six pieces of which the frame is composed in their respective positions, where they are located and held by the various clamping devices with all of the screw-holes in alignment.

The screws by which the parts of the frame are held together are fitted rather tightly to their respective threads. The assembler runs them in with an automatic spring screwdriver until he can drive them no farther by manipulating the handle, when he applies a fork wrench to the squared shank of the driver to send them in the few remaining turns. The assembled frame then goes to the grinding department and the screw heads are ground off flush, so that when the frame is enameled it is to all appearances a single piece.

A fixture on a Pratt & Whitney profiling machine, in which the side pieces of the frame are machined, is shown in Fig. 2. All of this work except drilling and tapping is done at one setting in the fixture, but requires six vertical settings of the machine spindle. The two side plates are right and left hand, the opposite side being machined in a fixture that is a duplicate of this one except that it is reversed. The work rests in the fixtures upon three fixed points and is further supported under the cuts by spring pins that can be locked in position after the piece is clamped. Three hardened steel guide-blocks, *A*, *B*, and *C*, guide the cutter in forming the contours.

The various vertical settings of the cutter to mill off the bosses of different heights, are made quickly by means of the latch and notched locking plate at the side of the spindle slide.

Fifteen holes are drilled simultaneously in the plate by means of the simple cover-plate jig shown in Fig. 3 on the table of the Pratt & Whitney multiple-head drilling machine. As in the case of the milling fixtures, there are two of the jigs, one right and one left, and they are used on separate machines so that no readjustment of the spindle positions is ever necessary. The cover-plate is not attached to the jig, but is located by four studs in the base over which it fits. Neither is the jig fastened to the table; therefore it may be drawn forward away from the drills for convenience in changing the work. A notched plate of steel, clamped to the



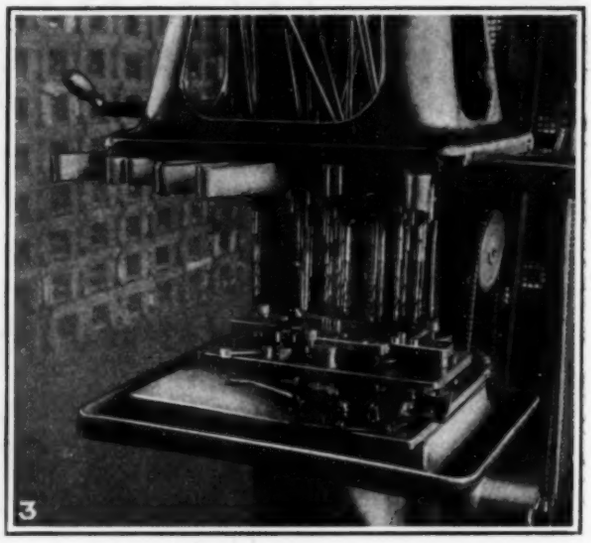
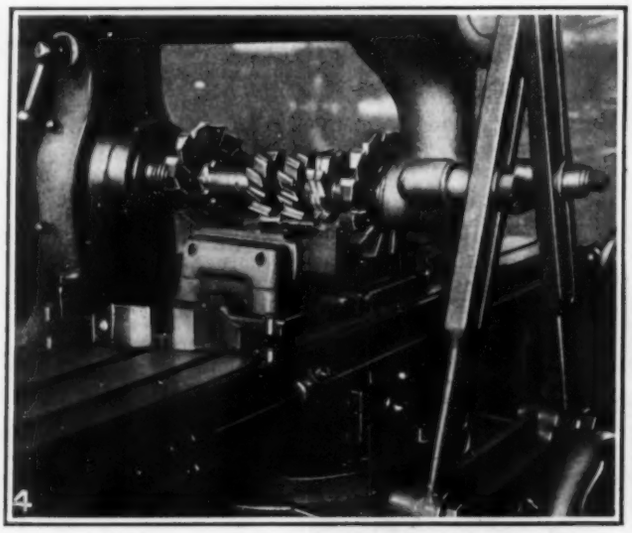


Fig. 2—Profiling bosses and pads of side frames. Fig. 3—Drilling 15 holes in the side pieces



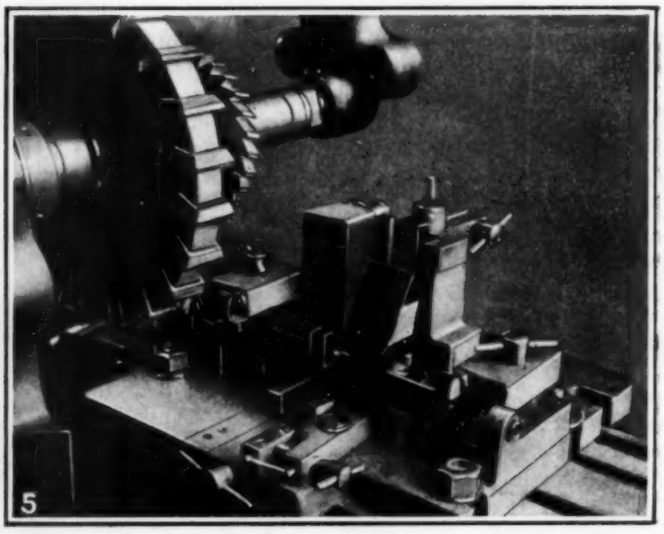
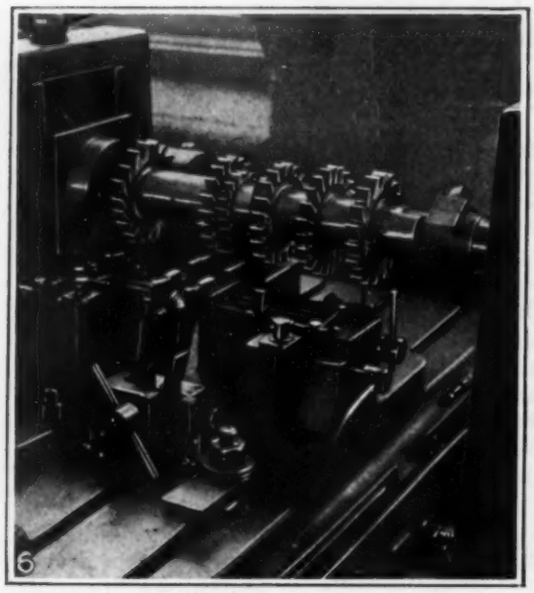


Fig. 4—Milling top and end of rear-frame brace. Fig.5—First machining operation on center tie



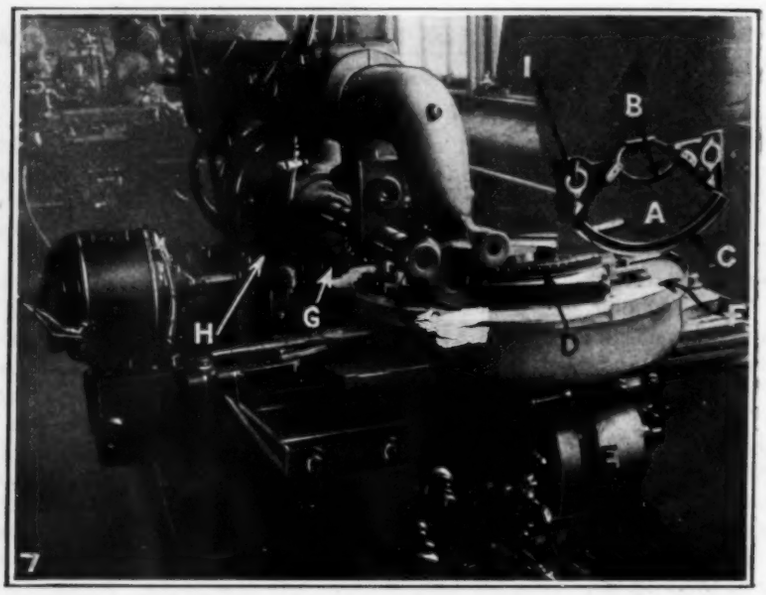


Fig. 6—Second machining operation on center tie. Fig. 7—Milling type-action-hanger slots

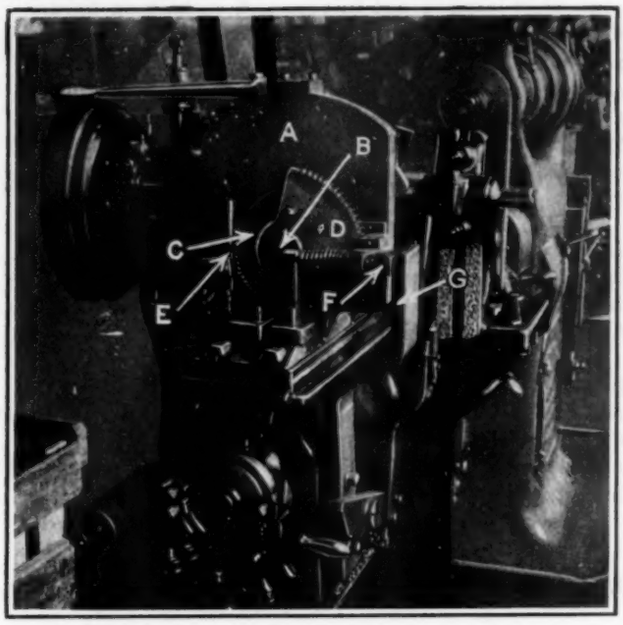


Fig. 8—Milling the slots in inner quadrant

table of the machine, engages the supporting posts of the jig and enables the operator to return it to drilling position without feeling for the bushings with the drills.

No jig other than a supporting plate is needed to countersink the through holes. Tapping is done on a multiple-spindle drill press carrying the different sizes of taps, and the work here is also guided by hand.

Of the front and rear braces that connect the side pieces, and to some extent of the two remaining parts of the assembled frame, it may be said that the shape is such that most of the surfacing can be done while the work is held in ordinary milling machine vises fitted with special jaws. Fig. 4 is a fair example of this, and shows not only the jaws but the gang of milling cutters with which the work is done. The cutters are mounted on their special arbor in the toolroom and are not disturbed elsewhere. When they need resharpening, the set is returned to the toolroom and the operator takes out a duplicate set, arbor and all.

Perhaps the most complicated piece to machine is the part called the "center-tie," shown in Figs. 5 and 6 in the fixtures; yet this piece requires but two handlings to reach all surfaces. Standard toolroom and Lincoln-type milling machines are used and the cutters, like those in the preceding example, are ganged up permanently upon their respective arbors. The tools shown in Fig. 5 were photographed from the rear of the machine in order to show the part to better advantage.

Cover-type jigs are used for drilling wherever it is practicable to do so, as with this type of jig it is necessary only to remove the cover to tap the holes. In cases where there are too many holes to be tapped to make it practicable for one operator to handle both drilling and tapping on one machine, a separate supporting jig without the cover is all that is required.

After the frame is assembled there are a few cuts remaining to be made, but they are of such nature and so located that all of them can be reached by a single end-mill, used in a profiling machine of the same kind and size as those used to machine the side plates, and at one setting. There are no box-jigs to be turned about to reach different surfaces at various angles, no detachable brackets to be removed and replaced each time a piece of work is handled, and not even a slip-bushing is used upon any of the fixtures.

The top plate of the typewriter, shown at *A* in Fig. 7, becomes a part of the frame, but it is an assembled part and is handled separately. Its main function is to support the sliding type-bars that are peculiarly a feature of the Noiseless machine. Twenty-two slots are sawed radially through the quadrant *B*, converging to a common center which is the printing point of the machine. The same number of slots—in fact the same slots extended—are sawed through the double quadrant *C*, where they may be seen at *D* in the part that is clamped on the fixture. Small drill-holes, parallel with and below the slots, also pass part way through this quadrant. The outer slots and the drill holes are made at the same time on an automatic fixture, shown in Fig. 7, which is mounted on a standard Brown & Sharpe milling machine to which some slight changes and additions have been made in order to facilitate the operations.

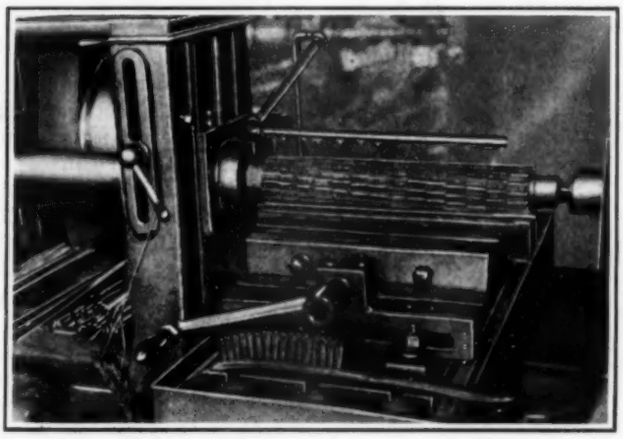


Fig. 10—Milling 168 teeth in carriage driving rack

Below the table at *E* is a barrel cam that is driven through bevel gears from the gear that originally supplied power to the feeds of the machine. A ratchet wheel and an index plate below the circular table *F*,

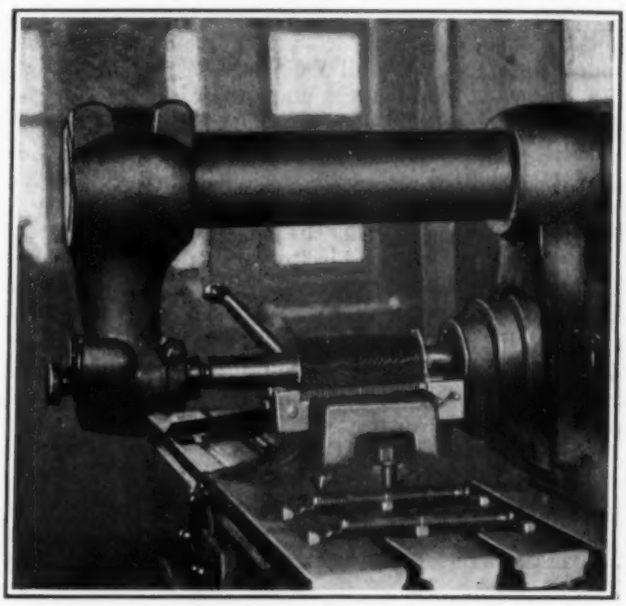


Fig. 9—Milling 22 slots in rear comb

steps the latter forward one notch at each withdrawal of the traverse table. The traverse screw and nut have been removed and the table is under control of the barrel cam.

On the left end of the table is mounted a small electric motor, to the rotor shaft of which is keyed a long sleeve fitted with a splined spindle carrying a drill chuck *G* at its outer end. The lever *H* swings on a bracket that is affixed to the traverse table, is yoked near the middle of its length to the splined spindle, and at its outer end (the end nearest the column of the milling machine) is connected by a slotted link to a stationary bracket.

Thus when the machine table moves forward, though the motor moves with it, the splined spindle carrying the drill chuck moves only half as fast; therefore, the work is advancing faster than the drill point is receding. By the use of this mechanism almost any rate of feed less than the actual rate of traverse of the table can be imparted to the drill by merely varying the ratio of the lever.

All of the surfacing cuts on this part have been completed before it reaches this stage, the work having been done as in the examples previously described in open fixtures and on profiling machines. One of the first operations to be performed is the drilling of the two holes at *I*, from which the piece is located in all subsequent operations including, this one.

Details of the Operation

A part is placed on the circular table as at *D*, located by studs that enter the two holes, and is clamped in position. A clutch is then engaged that starts the cam *E* in motion and allows it to make twenty-two revolutions, causing the traverse table to advance and recede an equal number of times. The ratchet and index plate step the circular table forward one notch at each movement and automatically disengage the clutch upon completion of the cycle, during which all the slots have been sawed and the holes drilled in the outer quadrant.

The continuation of the slots through the inner quadrant *B*, Fig. 7, are cut upon the machine shown in Fig. 8, which is a standard Pratt & Whitney semi-automatic milling machine. The fixture in this case is upright and the drilling mechanism is omitted. The view is taken from the rear and shows the indexing and knockout mechanisms, which are the same in principle though differing in detail from the larger machine.

In Fig. 8, *A* is an angle plate that is bolted to the reciprocating table of the machine. To the large stud *B*, which passes through this plate, is keyed the ratchet wheel *C*, the index plate *D*, and, on the other side of the angle plate, a sector that is provided with locating studs and clamps to hold the work. The pawl *E* is actuated by a fixed cam-block over which it passes as the table moves back and forth. The latch of the index plate is withdrawn by the fixed cam-block *F*, which is supported by the forged bracket *G* attached to the side of the machine. A coil spring returns the locking pin to its seat in the plate as the machine table moves forward to the cut.

Like the other fixture, this device goes out of action automatically after completing its cycle of twenty-two movements. While in the other machine the work passes under the saw, in this one it is fed straight toward the axis of the cutter arbor. The saw is but 0.031 in. thick.

The rear comb is another assembled part of the frame that is machined in very simple holding fixtures. One of the operations is to mill forty-four slots across it, as may be seen by observing the two finished parts lying on the table of the milling machine shown in Fig. 9. The material is cast iron and the slots are quite closely spaced; therefore the narrow projections must be well supported while the cutters are at work to prevent them from being broken out.

This holding fixture is the regular milling machine vise to which a pair of special jaws has been attached. The faces of the jaws are machined out to match the piece and are sawed through the upper edge with the same gang of cutters that are used to mill the work.

Another job that is a little out of the ordinary is shown in Fig. 10. It is milling the 168 teeth of the carriage driving rack at one pass. Four pieces are held in the vise at one time. This job calls for some very careful work in cutter making. There are fourteen of the cutters, each 1 in. wide.

What Becomes of Apprentice Graduates?

Apprenticeship training has decreased in the last decade while the need for it has been steadily growing. A recent study has shown that less than one-half as many apprentices are in training in manufacturing establishments and industrial schools as are needed to supply the normal demand for skilled craftsmen such as apprenticeship courses produce. This makes it particularly interesting to note what becomes of those who do complete such courses of training.

A manufacturing establishment that has conducted an apprentice school for over twenty years has kept records of the positions held by its graduates. During this time 808 men completed the course, and at the time the record was compiled about one-half were still in the employ of the company. Most of these were engaged in the trade for which they were trained, although a considerable number had been advanced to more important positions such as foremen or salesmen. Of the total number, 234 had advanced to positions of a higher grade than journeymen. Some had left the company and had become proprietors of their own establishments. Others had become superintendents or even executive officers of corporations. Only twelve had definitely left the trade for which they had been trained.

Care in Selection

This showing indicates a very high degree of effectiveness in the kind of training given. Possibly one reason lies in the very careful selection exercised in admitting young men to the course. Not only are applicants required to show by examinations or otherwise that they have the necessary preliminary education to profit from the course, but they must also pass a satisfactory physical examination and satisfy the superintendent in charge of the course that they possess those characteristics that give promise of their ability to work with other men.

Such characteristics are considered important since it is expected that many of the graduates will ultimately be selected for promotion to positions where they will be called upon to direct the work of others. Men passing this three-fold test should develop into first-class craftsmen. The results appear to warrant the care used.

Prepared by the National Industrial Conference Board.

The Principles of Die-Casting

By H. C. Skinner
General Manager, Franklin Die-Casting Corporation

Meeting the problem of undercuts in design—Examples of dies used in casting parts with and without undercuts—Undercuts and costs

ONE of the problems with which the die-caster is often confronted is the difficulty of casting parts having undercut sections. In the case of the sand casting the undercut is an every-day occurrence as the cores are not permanent, and can be crumbled to pieces in being removed from the casting. In the case of the die-casting, however, the core is of steel and the elimination of all undercuts is, therefore, of the utmost importance if the production is to be kept on an economical basis. At *A* in Fig. 14 is shown

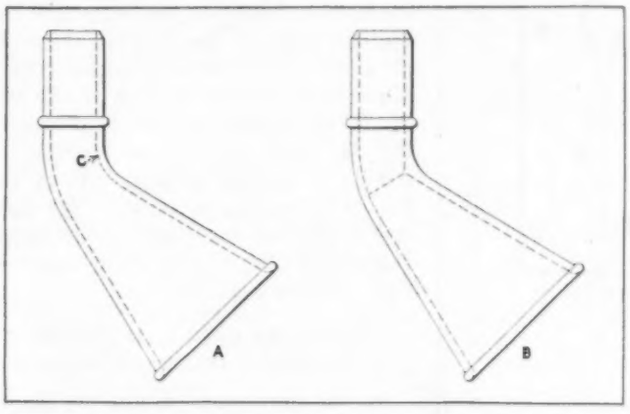


Fig. 14—Phonograph mouthpiece as normally designed (A) and as redesigned for die-casting (B)

a section of a phonograph mouthpiece as it would be designed normally. In die-casting this part, however, an undercut occurs at *C*. This undercut was overcome as shown at *B*, making it possible to draw the core without difficulty.

Construction of Mouthpiece Die

The construction of the die used in casting the mouthpiece is shown in Fig. 15. The main die section is divided into two plates, *A* and *B*, each plate being screwed to an outside plate, *A'* and *B'*. The two main plates contain cavities that reproduce the outside shape of the casting and also carry the cores *C* and *D* which form the inside. In casting the part the die is placed directly above the casting machine and is held in place by the die vise. The cores are brought forward into position by the pinions *E* and *F* working in ratchet teeth machined in the surfaces of the cores. The metal is then forced in and solidifies. The die is opened and the cores are drawn back free of the casting. The casting is then forced out of the cavity by the ejector pins *G* mounted on the plate *H* moving inside of the box *I*, and controlled by the pinion *J* meshing with the racks *K*. This is the general process of casting a piece such as the part shown.

In the casting shown in Fig. 16 it was impossible to overcome the undercut that resulted because the tubular section of the casting was smaller in diameter than the portion between it and the bend. This necessitated what is generally known as a collapsible core. The die in which this part was produced is shown in Fig. 17 in projection.

The main die plates are designated *A* and *B* and are fastened to the plates *A'* and *B'*. The plates contain the main cavity forming the outside. Plate *A* carries a pinion *C* which operates a rack *D* placed between the two plates and extending downward. On the end of this rack is placed the core *E*, which forms the hole of the tubular section of the tone arm. The main core for the inside of the tone arm consists of the sections *F* and *F'* held together by the screw *G* and controlled by the pinion *H*, meshing with teeth cut into the side of the core *F*. The core *J* forms a small hole in the top of the arm and is pulled back by a toggle joint mounted on the edge of the die but not illustrated.

The Operation of Casting

The die plates are screwed to opposite plates of the die vise and in operation are brought together directly above the opening to the machine. The metal is then forced in through the gate *I* and solidifies. Core *E* is drawn back. Screw *G* is turned until it is freed from section *F'*, when core *F* is drawn out. Core *J* is pulled back. The casting is then ejected from the die in a

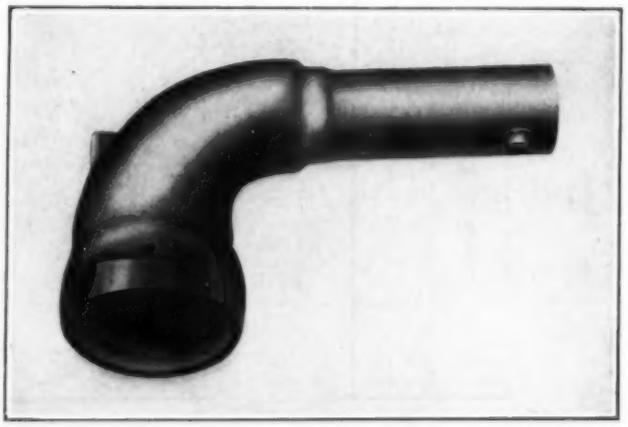


Fig. 16—A casting in which it was impossible to overcome the undercut

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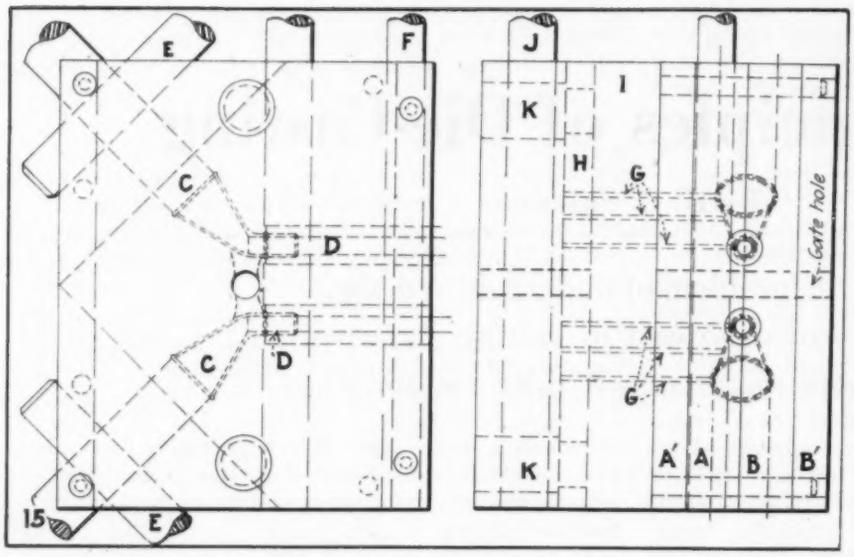


Fig. 15—Die used in casting the mouthpiece shown in Fig. 14

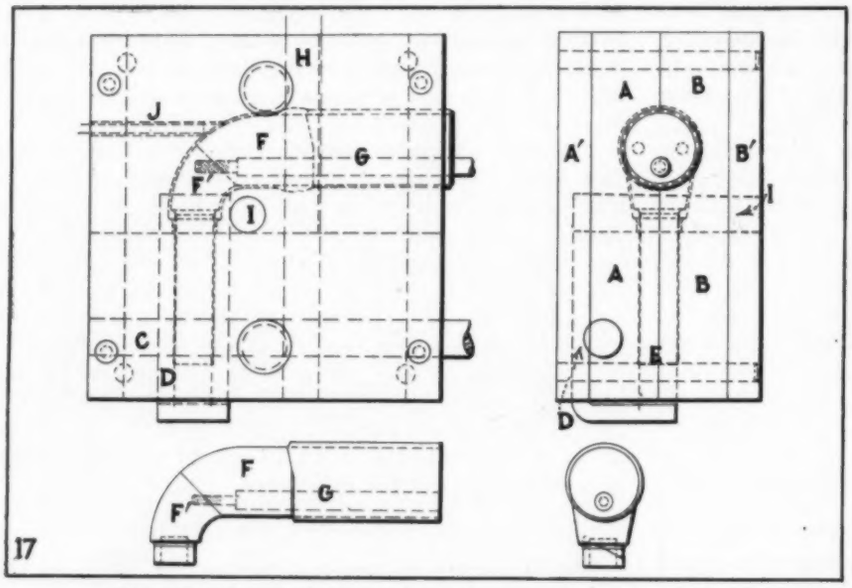


Fig. 17—Die used in casting the part shown in Fig. 16

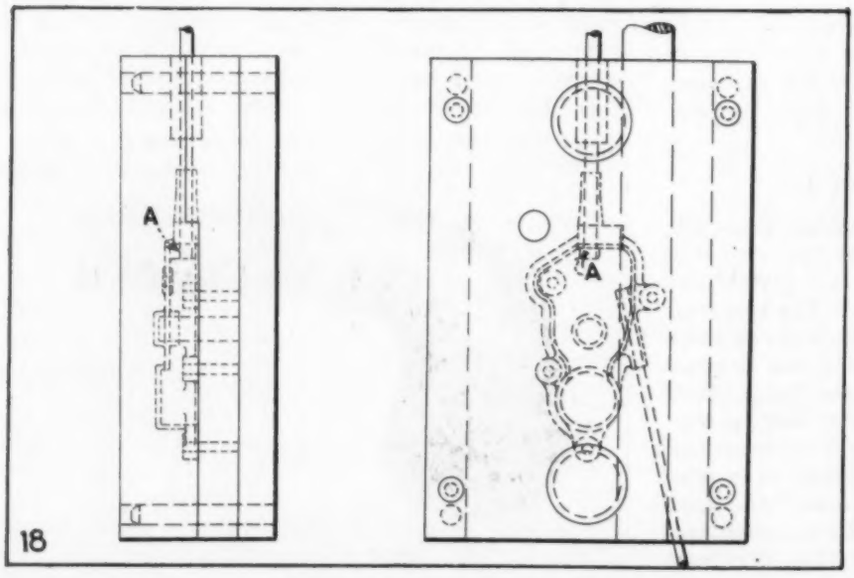


Fig. 18—Die in which a slight modification to eliminate undercutting increased production 50 per cent

manner similar to that explained in connection with the previous die. Core *F'* is still embedded in the casting and must be gotten out. Its removal is accomplished by inserting a bar in the hole left by core *E* and pressing downward so as to release core *F'*, which falls into the larger section of the cavity and thence out. This is a rather slow method of producing the casting as compared with the means which could be employed if the undercut could have been eliminated and shows why the elimination of the undercut is so important.

Interior Projections

Another form of undercut likely to make the die-casting of various parts more difficult consists of projections, in the form of lugs or bosses, extending from the side wall of the casting into the inner cavity. In the die shown in Fig. 18 the section marked *A* was originally a circular boss with the section between the boss and the bottom wall of the casting forming an undercut that would normally have required a collapsible block in the die. By filling in this section as shown in the die drawing it was possible to push the casting directly out of the die, thus making a very simple casting operation, the slight modification increasing the speed of production fully 50 per cent.

Two-Part Core Used Where Undercut Is Unavoidable

In the part made in the die shown in Figs. 19 and 20 it was not possible to eliminate the undercut and it was therefore necessary to make the main core in two parts, *A* and *B*. Core *A* is drawn out of the casting by means of the pinion *C*, that meshes with teeth cut in the core. This leaves the section of core designated as *B* embedded in the casting when the casting is removed from the die and it is necessary to drive this core off the projecting lugs which form the undercut. One of the chief objections to the use of such collapsible cores, especially in the case of an aluminum casting, is that it is impossible to remove the core as quickly as in normal production and the tendency for the casting to shrink onto the core, causing cracking, is thereby increased. The percentage of spoilage is much greater, thus adding to the cost of production beyond the actual time represented by the removal of the extra core from the casting.

Number-wheels, dies for which are

shown in Figs. 21 and 22, afford examples of two parts similar except that one has a center hole plain except for a key, while the other has a circular groove extending from one side of the key around the main opening to the other side of the key. The presence of the key made it impossible to supply the groove by a machining process and a collapsible core became necessary. The casting of the outside section of the wheel is the same in each case, that is, the wheel is formed at ten slides, each carrying a number. The slides are drawn back by cam mechanism, releasing the casting so that it can be pushed out when the die is opened.

Arrangement of Cores

In the line illustration, Fig. 23, is shown the arrangement of the cores that form the undercut. Drawings of the wheel itself are shown at *A*, *B* and *C*. The wheel with a shaft embedded is shown at *D* and various sections of the core are shown at *E*, *F*, *G*, *H*, *I*, *J* and *K*. The section shown at *J* is drawn back while the casting is still in the die, leaving the casting practically as shown at *M*. The sections *F* and *G* are then pushed out, leaving the section *H* and *I* still embedded in the casting as shown at *N* and *O*. These remaining sections are removed one at a time as shown at *P*, *Q*, *R* and *S*. It is readily apparent that the production of the type of wheel without the groove is much more rapid than with the groove.

Simplify Design

In giving these illustrations of what it means to cast undercuts it has not been the aim to discourage the use of die-castings even where undercuts are necessary, but to impress upon the reader the importance of eliminating the undercuts wherever permissible, as in many cases the customer can thereby save materially through a little added effort in symplifying his design. The writer knows of several cases where, had the part been originally designed in the form later adopted, a marked saving would have been made both in the original cost of the die and through its simplified operation. There is too much of a tendency on the part of some customers to interpret suggestions intended for their benefit as a mark of weakness or lack of ability on the part of the die-caster, whereas such suggestions usually indicate a genuine interest

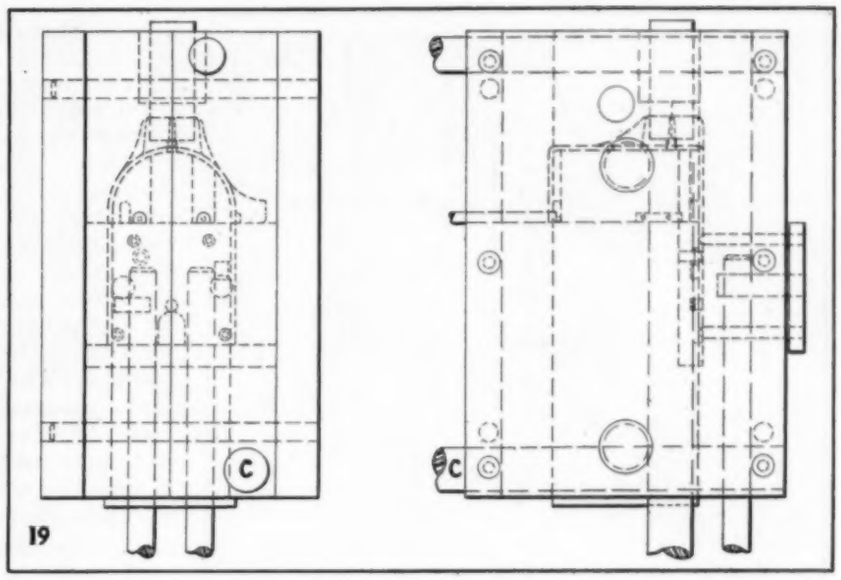


Fig. 19—Die in which a collapsible core was used

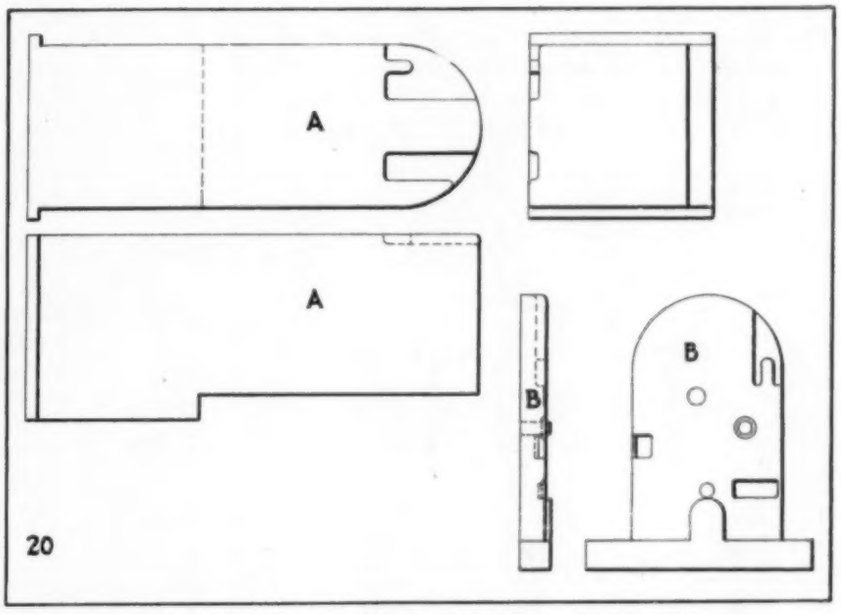


Fig. 20—Cores used in the die shown in Fig. 19

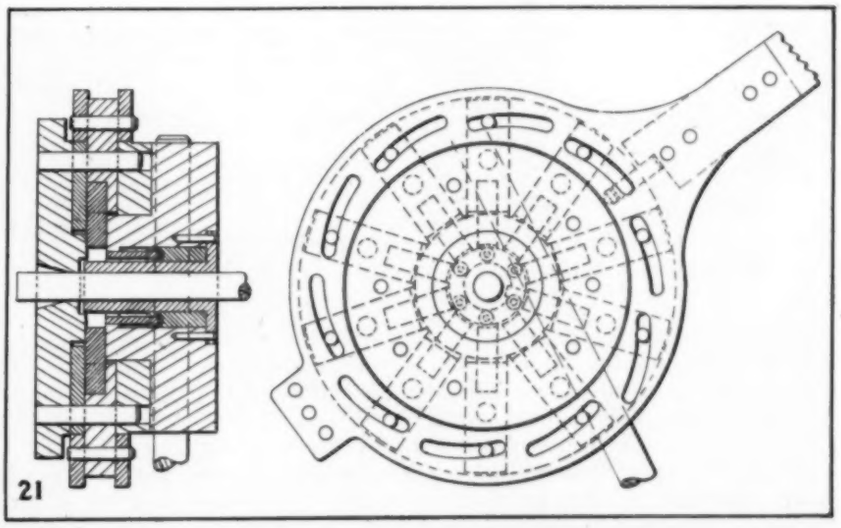


Fig. 21—Die for number-wheels with center hole plain except for key

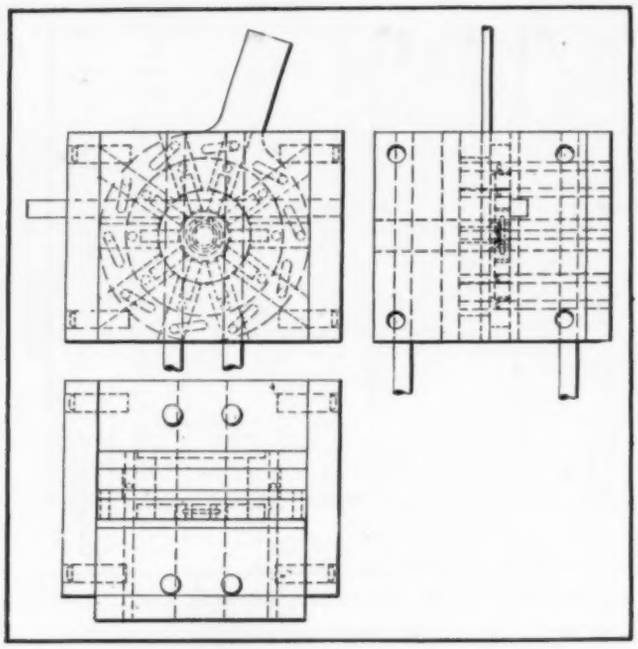


Fig. 22—Die for number-wheels, with center hole complicated by key and circular groove extending from one side of the key to the other, requiring collapsible core

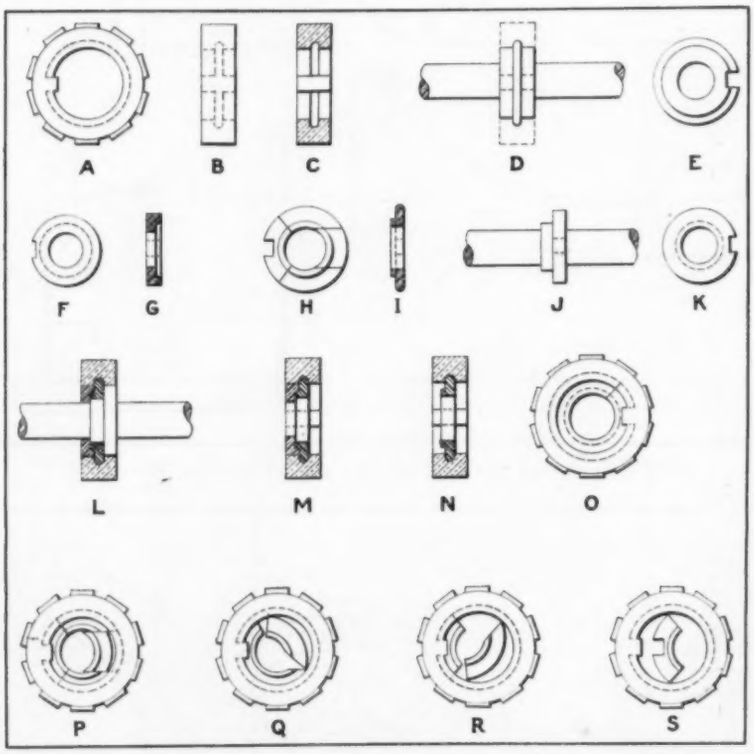


Fig. 23—Cores used in the dies shown in Figs. 21 and 22

and an effort to be of real assistance. There is still required much of education on the part of the user of die-castings in order to bring about a realization of the economies possible by means of the process.

Whether a part is produced by die-casting or by methods involving machining depends entirely upon cost—and cost, in turn, is greatly affected by the way in which the design has been worked out.

(To be continued.)

Standard T-Slots—Discussion

By C. B. Hughes

On page 880, Vol. 61, of the *American Machinist* there was an announcement of a committee appointed to look into the matter of standardization of T-slots. I am much interested in this standardization, for my shop experience has been that in some very good machine tools, the matter of T-slots and bolt slots seems to have been given very little consideration, either in the designing or producing of the machines. The engineers or the designers of these machine tools seem to have been under the impression that special bolts with special heads will be used in the slots. But railway repair shops and small job and contract shops have no time to make different-length bolts with special heads. If the slots were made standard to fit the U. S. S. bolt head, it would be an easy matter for an operator to make a set-up in minimum time.

Bolts with Special Heads Are Sometimes Necessary for Large Work

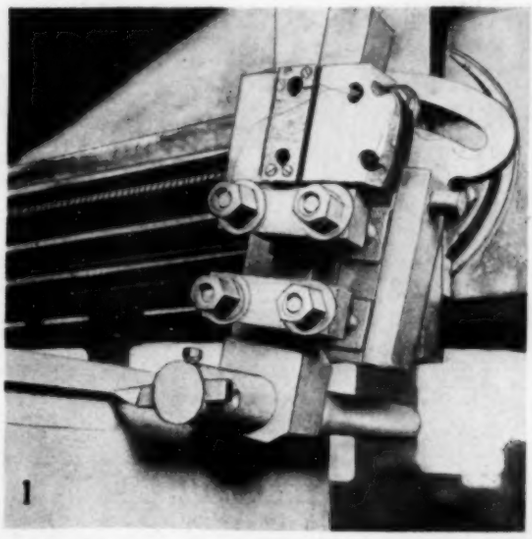
Of course, it is sometimes necessary to use some special-head bolts in the T-slots that will withstand the strain in machining certain jobs, such as on large planers, vertical boring mills, slab millers and other heavy-duty machines. Even in the majority of these machines, the special bolt head may be avoided by using a standard stud block. The stud block is a sliding fit in the T-slot and is tapped to receive the stud end of a rod-bolt or stud made to U. S. S. specifications as to diameter and thread.

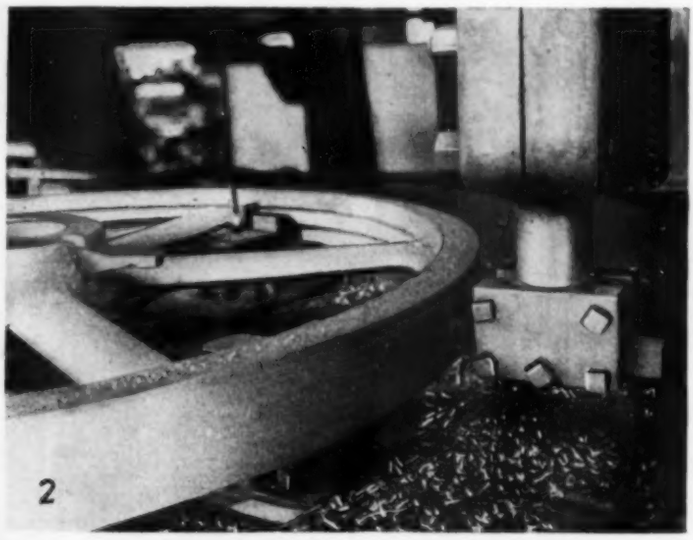
Why do not manufacturers of milling machines, planers, slotters, boring mills, etc., having T-slots, send a slot-cleaning tool with the machines? A tool of this kind has to be made by the company purchasing the machines, and it is usually quite expensive when made from an old file or cut out with a hack saw from sheet metal and ground to size.

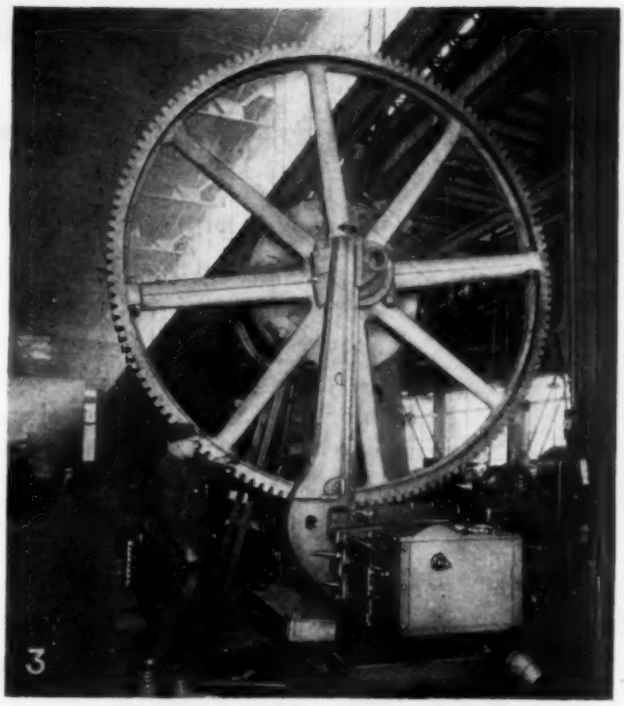
The cored bolt slots in lathe faceplates and drill-press tables seem to be given less consideration than the T-slots. It is very important to have these slots all the same size throughout their width and depth, from front to the reverse side. I have worked on a number of drill presses and lathes in the shop, and a third hand is often necessary to keep the bolt heads from turning while tightening the nuts and holding the work against the faceplate or drill-press table.

Some Suggested Remedies

Why not cast ribs on each side of the bolt slots, or core a recess on the back side of the face plates and drill-press tables to keep the bolts from turning when tightening the nuts? Some lathes have faceplates provided with recesses for holding the heads of bolts, and they certainly meet with approval in the shops. Is there any reason why this cannot be adopted by all? It may seem a small matter, but when you see an operator fooling away time fitting bolts to the slots and trying to line up a job and tighten it down at the same time, using a wrench in each hand, the amount of time that may be lost in a year from this cause can be appreciated.







Handling Large Contract Work

Photographs by courtesy of the Plamondon Mfg. Co., Chicago, Ill.

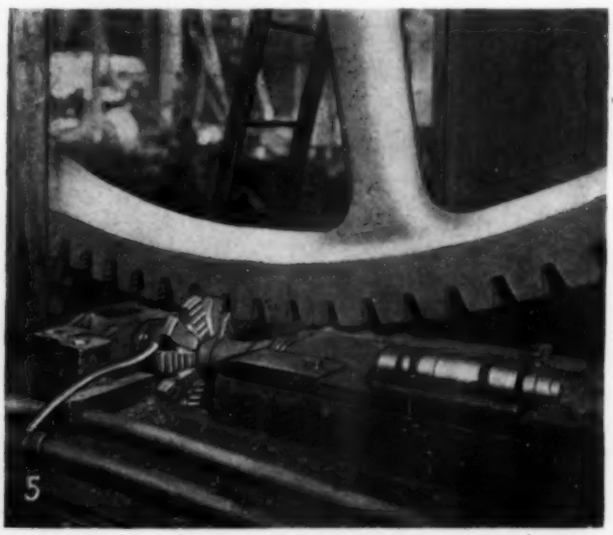
1—Planing a large bed

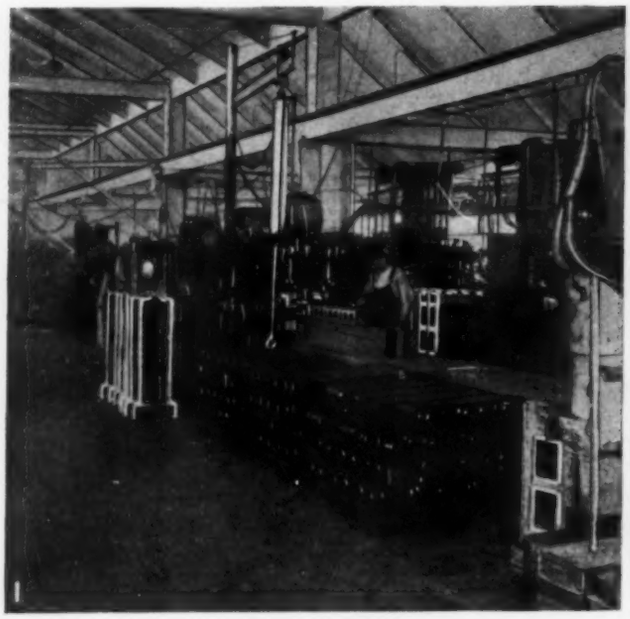
2—Turning a good sized gear blank

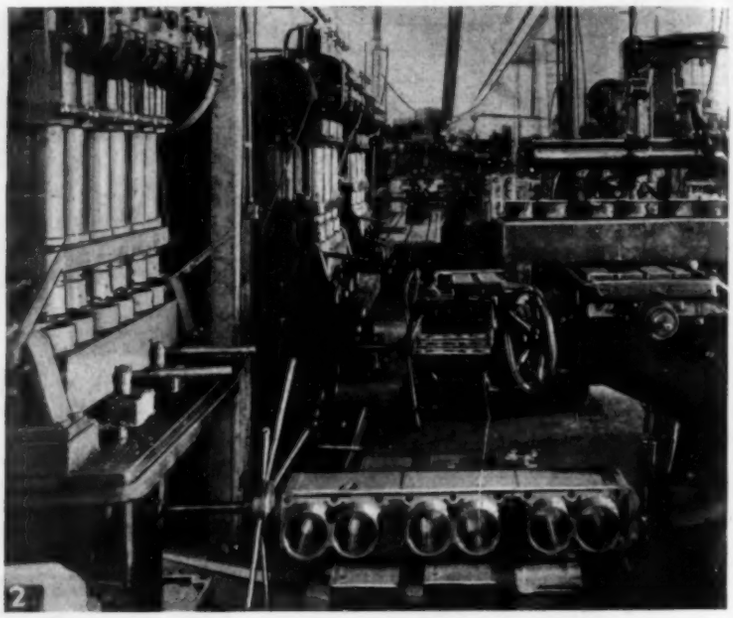
3—Cutting a 12-ft. gear on a home-made gear cutter

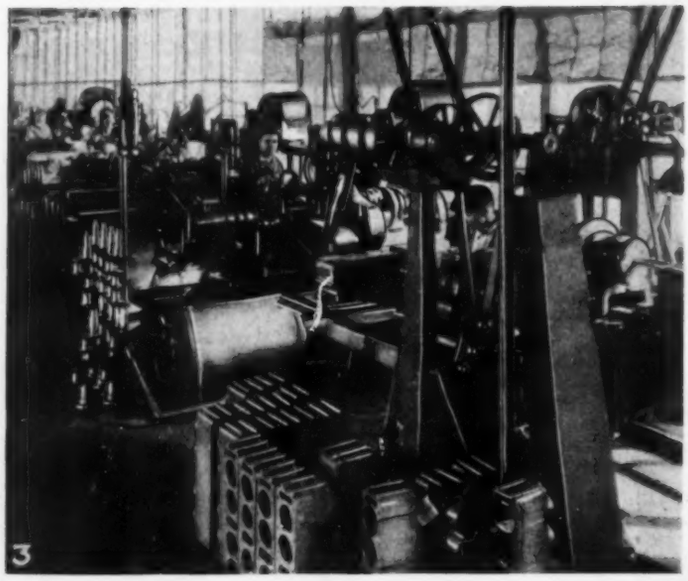
4—Cutting the keyway

5—Details of the gear-cutting spindle









A Motorized Motor Shop

1—Milling cylinder blocks

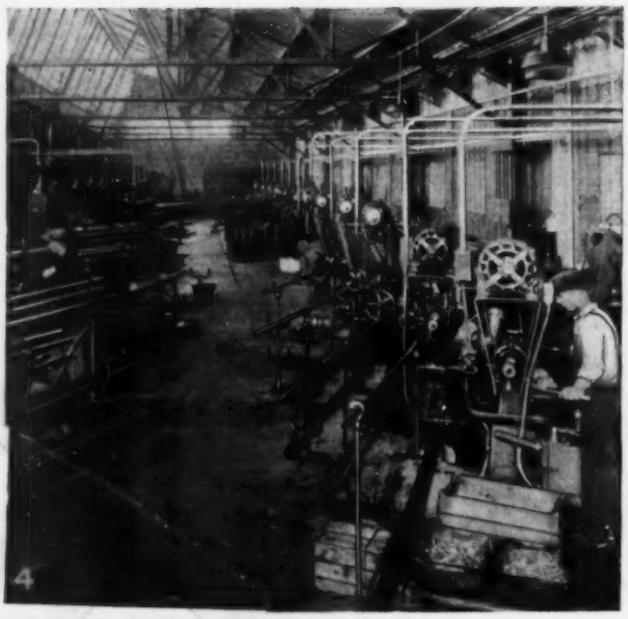
2—Boring and reaming 6-cylinder motor blocks

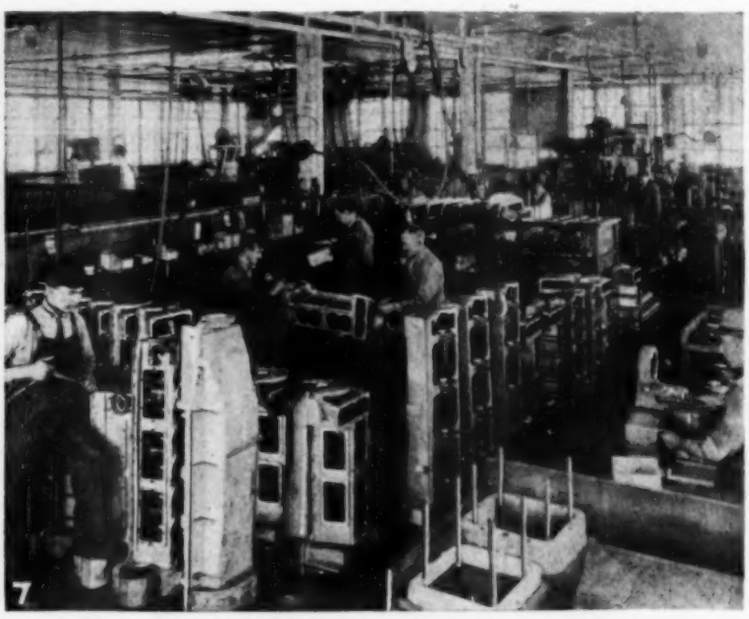
3—More cylinder-block operations

4—Motorized automatic screw-machine department

5—Machining cylinder heads

Photographs by courtesy of the Hall-Scott Co., Berkeley, Calif.





on the Pacific Coast

6—Work on the crankcases

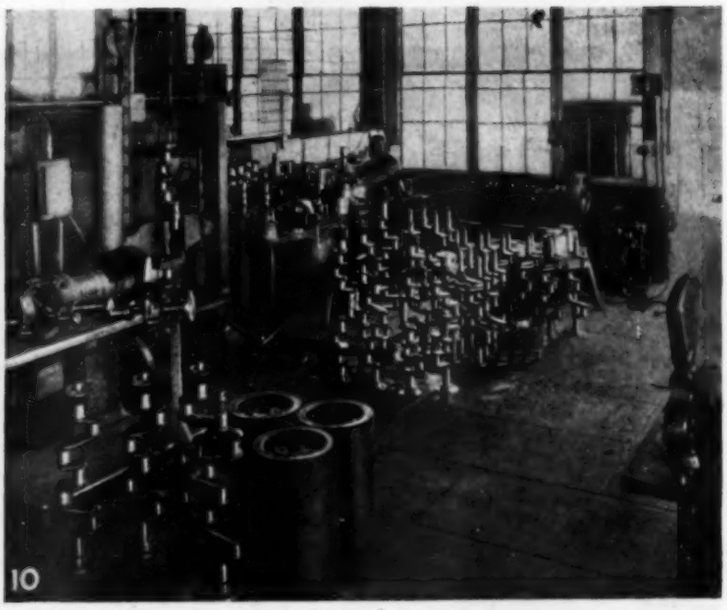
7—Finishing crankcases for assembly

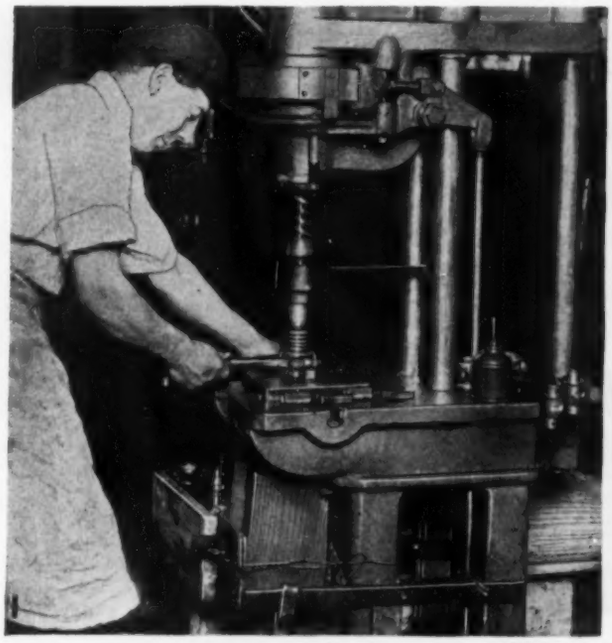
8—The connecting-rod department

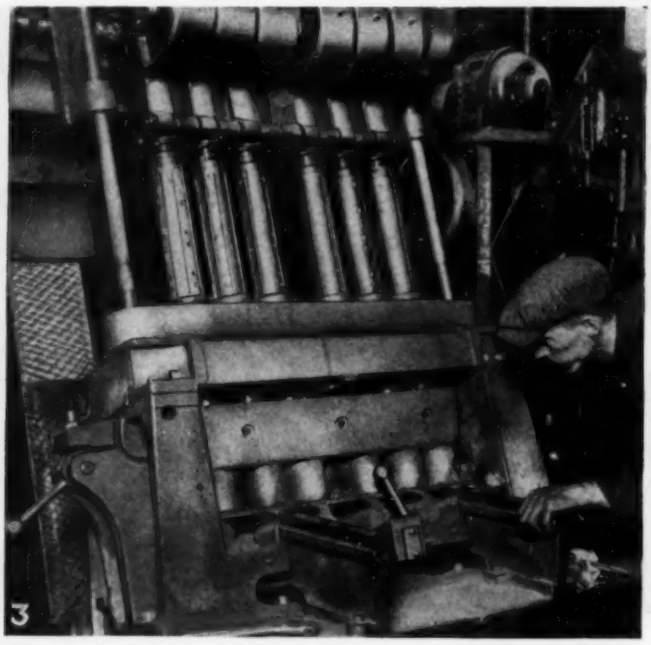
9—Where crankshafts are ground

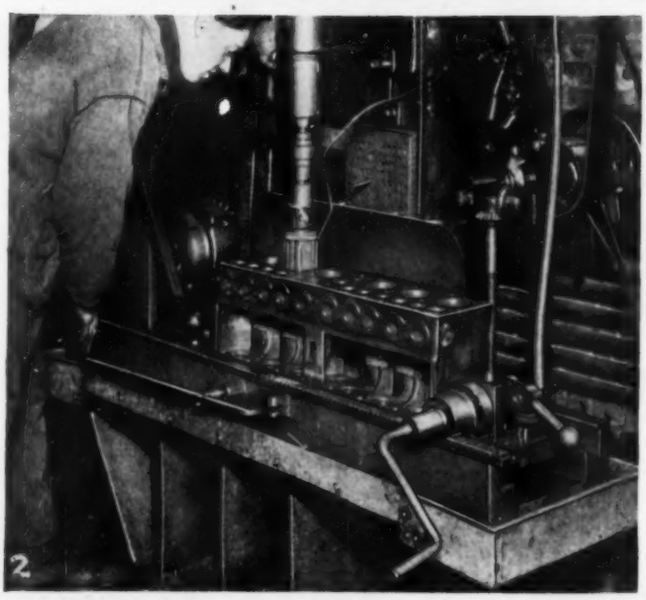
10—Testing and balancing crankshafts

The extensive use of individual motor drive is of interest, this being a recent change in the equipment of the plant. Motors are particularly in evidence in Figs. 4 and 9, the latter showing the motors guarded against both abrasive and steel particles.









Motor Shop Operations

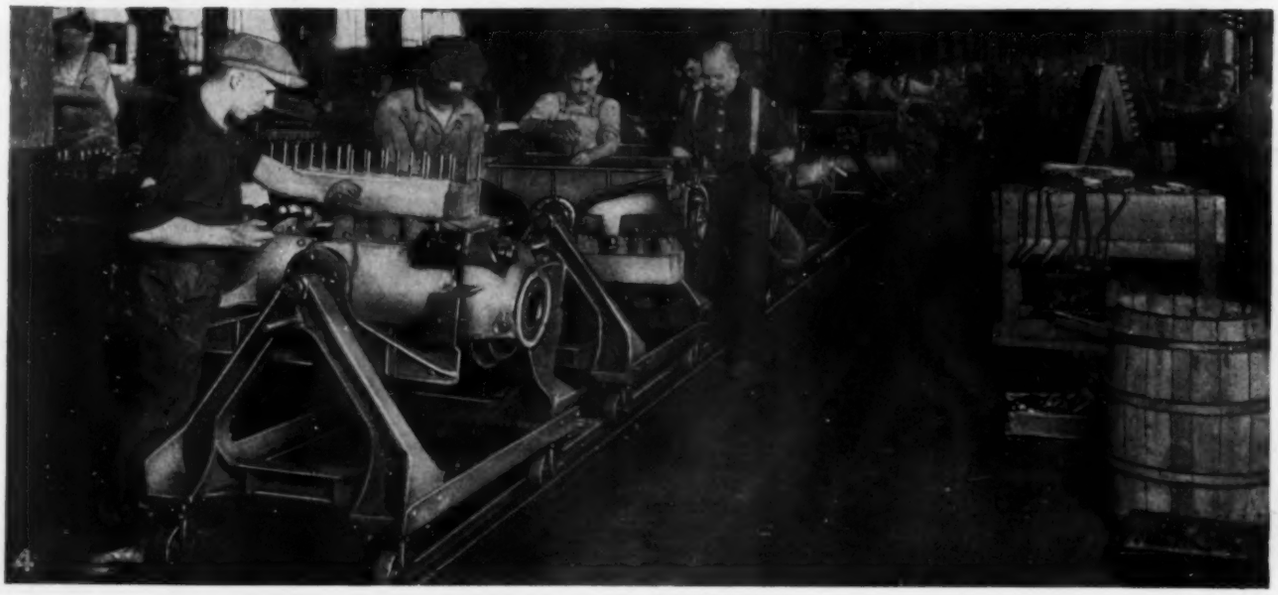
1—Finishing large-end connecting-rod bearings in a screw press—foot control

2—Boring the cylinders

3—Honing cylinders—note index pin and lever, and method of traversing block

4—Assembling stands and track

Photographs by courtesy of the Cleveland Automobile Co. Cleveland, Ohio



Trained Leadership for the Factory

By J. K. Novins

A well-organized foremen's suggestion system — Inter-department and inter-plant visitation—Questionnaires used to guide the foremen — Records and observations — Discussions with management

FIVE years ago the International Harvester Co. introduced in its manufacturing plants throughout the United States and Canada the industrial council plan of employee representation. Under this plan the company extended a voice in the management to 40,000 employees, including 2,000 foremen, in twenty-three plants. As a direct result of the introduction of the plan, the company, with the consent and initiative of the foremen, developed a foreman training program. This was made necessary because under the plan the foremen began to exercise, in the words of an executive of the company, "the dignity of real leadership."

The foremen's development course, introduced in the various manufacturing plants of the International Harvester Co., proved entirely successful, in several respects. The foremen were made aware of their true position in the new order of management, and they became an effective medium of communication between the company and its workers. The foremen received a thorough grounding in the principles of scientific management, such as the matters of personnel relations, the setting of piece work rates by times studies, production planning, the details of department records, the reckoning of manufacturing costs, shop, machine and material control, products of the company, and numerous other phases of efficient management. The instruction was supplemented by giving each foreman an opportunity to visit various departments in the plant in which he is employed, to observe the actual application of the principles he had learned.

However, it became apparent that a systematic follow-up to the foreman training program was in order. In other words, the stage was reached when the foremen should be given an opportunity to give the company the full benefit of their training. Therefore, during May, 1923, the company devised a comprehensive interplant visitation program for its foremen.

The interplant visitation program evolved required systematic scheduling of foremen's visits through a period of time, and the drawing up of a series of questionnaires to enable the foremen to study production methods in the plants visited and to report suggestions for improvement. In addition to assuming the real dignity of leadership, the foreman became regarded as one of the company's production experts. The special training had given him a broader viewpoint and a desire, as well as ability, for scientific investigation.

This program has been consistently carried out to this day. An investigation to determine the tangible results is in progress at the time of the preparation of this article. Through the courtesy of the company the writer is able to present an outline showing the practical operation of the interplant visitation program.

> COMPARATIVELY few organizations are taking full advantage of the strategic position of their foremen. Linked between men and management, the foreman can be conversant with the problems of both, and can provide the solutions of many stubborn problems if given the chance.
>
> Fine stimulants for the foreman are frequent visits to other plants. From their effects worthless ideas die and good ones are born. Such visits constitute the backbone of the suggestion system of one of our very large factories, as explained in this article.

The purpose of the visitation program is outlined by the company as follows: "Visits by general foremen, foremen, assistant foremen, safety men and others to departments handling similar lines of work in other plants of the Harvester company for the purpose of interplant inspection, investigation, benefiting by each other's experience in matters of safety, supervision and manufacturing processes."

The application of this program: "This program must be carried out in such a way as will best serve to develop those participating as well as being the means of mutually determining the best, safest and most economical methods of manufacture."

Outline of a Program

To accomplish these purposes "in the most effective way with the least interference in the routine of supervision at each plant," the company has drawn up the complete program as follows:

1—The foremen at each plant will be divided into five groups.

A—Foundry and affiliated work (pattern shops, core room, cleaning or mill rooms).

B—Forging and affiliated work (belting, nut, steel wheel, punch and shear departments).

C—Wood shop and affiliated work (canvas room, wood wheel departments).

D—Mechanical work (such as tool room, millwright, carpenter, electrical, maintenance departments).

E—Miscellaneous work (other departments such as assembling, paint, yard, machine shop).

The twine mill foremen will be divided up into groups peculiar to twine manufacture.

a—Preparing group.

b—Spinning group.

c—Balling group.

d—Miscellaneous group, consisting of mechanical department, opening room, rope department, warehouse.

The Wisconsin steel mill foremen will be divided into five groups peculiar to the steel mill work but related as closely as possible to the groups as outlined for the manufacturing plants.

2—From each of these groups a visiting committee of three to six men will be selected. The personnel of these committees should change from time to time in order to give all of those qualified an opportunity to visit the other works.

3—The superintendent, his assistant and possibly one representative from each group (for instance, the works engineer from the mechanical group or the foundry superintendent from the foundry group) will designate the foremen to compose the visiting committee.

4—The superintendent will designate some person to be in charge or act as chairman of the visiting committee. Probably the assistant superintendent, works engineer, master mechanic or some other person to be named by him will act as his personal representative.

5—Whenever possible the plant safety inspector or one of the members of the plant safety committee should be a member of the visiting committee.

6—Only one visiting committee will leave a plant during any one week.

7—Only one visiting committee will be received at a plant during any one week.

8—The visiting schedule has been so arranged that the committee will visit the other plants in such a way as to avoid any conflict. In so far as it is possible, the foremen of the department visited one week will return the visit during the week immediately following.

9—The superintendent or his assistant will arrange the day each week on which his committee will visit, making such arrangements as will best suit the superintendent of the other plant, as well as to best meet the local conditions within his own plant.

10—The superintendent will meet each week with the visiting committee (together with all other interested foremen) to discuss the results of his committee's experience at the other works and the results obtained. The recommendations made by the foremen will be outlined in weekly reports by the superintendent to his works manager.

11—Every sixth week of the schedule, at which time representatives of each of the groups will have made a visit to another plant, is an open week; that is, there will be no visiting. During this week the superintendent should hold a general meeting of all foremen, discuss the results of the visits made up to that time and the progress made, and utilize this opportunity for discussing safety matters, schedules, production problems and kindred subjects. A general report of this meeting should also be sent to the works manager.

12—During the seventh week the first visiting committee (composed of a somewhat different personnel) will again go out, but to a different works and in this manner the visits will continue until all of the committees have visited all of the Chicago works and a new schedule is drawn up.

13—Each visiting foreman will be supplied with a questionnaire outlining what he is expected to observe and what he will be required to give written answers to. This questionnaire has been compiled for the purpose of standardization and also as a means of readily recording items of interest, and it is expected that the superintendent will add to it, or by specific instruction direct the foremen's attention to matters of particular interest not mentioned therein.

Five Sets of Questionnaires

There are five sets of questionnaires, a set for each department: twine mills, wood, foundry, forge and mechanical, and one marked "Miscellaneous." The questions are modified to suit the specific needs of the foremen in the respective departments. On top of the blank the foreman records his name, the name of the works in which he is employed, the works visited, his department and the visiting date. The questions in each case are preceded by the following set of instructions:

"In making arrangements for interplant visitations for foremen, it is intended that each person concerned will carry out such a program, in a way that will not only best serve for his own personal development but be the means of mutually determining the best, safest and most economical manufacturing methods.

"This report must be filled in by the visiting foreman and returned to his superintendent. It is not intended that the following list of questions should confine the foreman in any way in his personal inspection and investigation of the department visited. It has been compiled for the purpose of standardization and also as a means whereby items of interest may be readily recorded."

Here is the list of questions prepared for the foremen from the twine mills:

1—Record your impression upon entering the department, noting those things which may be vastly different to conditions within your own department.

2—Particularly watch for efficient safety measures, practices and equipment. What safety measures or devices most appeal to you?

Do you notice any improved machine safety guards, exhaust systems, and the like? Are the employees exercising the most precautions in the way of wearing apparel? Do the female machine operators wear standard uniforms? Do you notice anything of a hazardous nature? If so, what and why hazardous?

What do you recommend for bettering their conditions?

3—Investigate particularly the methods of manufacture in comparison with your own. Have you any recommendations which might prove advantageous in your department, or in theirs?

4—How do their methods of handling heavy work compare with yours? Have they improved mechanical devices for doing away with hand work? What can you consistently recommend for increasing output, reducing the necessity for human labor and lowering costs?

Have you recommendations on this point which might prove advantageous to them?

5—Check their methods of inspection and testing twine. Have you any recommendations to offer on this point?

6—Observe their practices for reducing and eliminating scrap and waste. Make any recommendations which would better conditions in your department.

7—Have we methods for scrap and waste elimination

which might prove beneficial to them? If we have, what are they?

8—Investigate thoroughly their methods of supervision, incentives, labor questions, day work, piece work, records, maintenance, costs and inspection methods and record any items of particular interest.

9—Note carefully the orderliness, cleanliness and general departmental appearance.

10—Miscellaneous. Note general items that attracted your interest.

11—Items of special interest to be investigated.

For the woodworking foremen the questions are changed to apply specifically to their own department conditions. The first and last three questions are the same. In the question on safety measures, the woodworking foremen are told to watch for the following points:

"Do you notice any improved machine safety guards, exhaust systems and the like? Are the employees exercising the most precautions in the way of wearing apparel, especially the operators on boring machines? Is the anti-slip covering around the machines in good condition? Are there positive locks for control levers when the driving devices are in the neutral position? Are square-head knives used? Note the condition relating to piling of lumber or parts in process of manufacture and loading of trucks. Do you notice anything of a hazardous nature? What and why hazardous?

Some of the Points Covered

With the exception of the above, and the third and sixth questions, the questionnaire is similar to the twine-mills questionnaire. The points covered in the third question are: Investigate their machine tools and also the equipment used, i.e., knives, cutters, saws, forms. Is their equipment much more efficient than that you are using? Have you recommendations to make?

The sixth question is: Check their methods of inspecting and grading lumber, and also the initial operations of stock sawing, noting particularly the waste and salvage features. Have you any recommendations to offer on this point?

The second, third and fifth questions in the foundry foremen's questionnaires relate to the foundry, other questions being of a more general nature, similar to those in the twine mills questionnaire. The second question, relating to safety, covers the following points: When hot iron is being handled by pourers, bull ladle men, molders or others, do they wear leggings? Goggles? Molders' shoes? Do grinders and chippers wear goggles? Are the sand-blasting methods all that are desirable? Are the grindstones equipped with exhaust systems? Do the grinders wear respirators? Are the tumbling mills properly guarded? What are the conditions of the aisles or gangways? Is there "open" chipping, which should be screened? Did you notice anything of a hazardous nature? If so, what and why? What do you recommend for bettering their conditions?

The third question is: Investigate the equipment used, molding machines, plates, dryers, flasks, core-box equipment. Is their equipment much more efficient than that you are using? Have you recommendations to make?

The fifth question is: Check into their cupola practice, melt, methods of charging, topping, pouring. Do you find their practices better than your own?

Forge shop foremen are required to watch for the following points in regard to safety measures in the forge shops:

Is the forging and other work properly screened to prevent flying sparks? Are the punch presses, shears, hammers and bulldozers safely guarded? Note if there are sliding feeds, kick-out or blow-out facilities on punch presses, and whether operators place or remove stock from dies with the hand, or by other tools such as tongs. Do the punch press operators wear goggles? Note the conditions surrounding the piling of raw materials or parts in process of manufacture, loading of trucks, floor conditions. Are there positive locks for control levers when the driving devices are in the neutral position? Note facilities for storage of dies and rails. Did you notice anything of a hazardous nature? If so, what and why hazardous?

Safety Measures and Care of Tools

Two questions in the mechanical department foremen's questionnaire relate to safety measures and care of tools. The safety measure points the mechanical foremen are required to watch are listed as follows: Note especially the safety measures pertaining to electrical hazards, elevators, scaffolding, guarding of machine tools, safety measures in dies, tools and equipment used by piece workers, positive locking controls for shifting levers when driving devices are in the neutral positions. Do you notice anything of a hazardous nature? If so, what and why hazardous?

As to machine tools and equipment: Look over the machine tools and general manufacturing equipment, tools, dies, jigs, and fixtures. Is the equipment more efficient than that we are using? What recommendations have you to make?

The questions in the miscellaneous department questionnaire cover all the above points in a more general way, without respect to any specific process.

The questionnaires are handed to the foremen in mimeographed form. Following each question is sufficient blank space for the foreman to jot down his impressions and suggestions. The questionnaires are handed to the foremen in advance of the visiting date, enabling them to study the questions. When they visit the designated plant they know exactly what to look for and what to overlook.

The questionnaire, properly filled out, is of some value to the various production departments. Not only does the foreman receive new ideas for his own shop, but his suggestions for certain definite improvements often are of equal value to the plant he has visited. This is the best point in favor of the system.

The management, after reading and tabulating the suggestions, can lay its index finger on raw spots in the production system. When two thousand foremen make suggestions on a specific point, the management has a basis on which to work. This is a departure from the old suggestion system, when the presentation of a valuable suggestion by a foreman or worker depended purely on accident and the haphazard exercise of the inventive spirit.

Whatever success the visitation program will have will be due, in the main, to the training the foremen receive as the result of the introduction of a systematic training program. Executives in all lines of manufacture will be interested to watch the further development of the experiment which appeals to the author as an indication of the recognition the foreman has gained as the trained expert of industry.

Exporters Should See the Whole Picture

THE manufacturer or exporter who confines his scrutiny of business trends to his commodity alone may be, and probably is, overlooking information which may be quite as applicable to his problem as is that obviously connected with the present demand for his own kind of goods, states an editorial by Clayton Lane in *Commerce Reports*, published by the Department of Commerce. To estimate his market correctly the executive must broaden his perspective sufficiently to include observation and analysis of those trade and economic factors that contribute to market conditions generally.

Although there are extremely encouraging indications of an ultimate return to economic stability in Europe, the conditions basic to that recovery are still very much in flux. It is true that currencies in many countries have attained or are apparently approaching stabilization, labor troubles have been in many cases amicably settled, and barriers to normal international exchange of goods have been modified or removed.

There still remains, however, major difficulties, upon the successful settlement of which depends a real trade revival. The American exporter, if he is successfully to meet in Europe the competition of those who are nearer the market, must be as adequately informed upon the influences of changing economic conditions as are his European and other competitors. Price fluctuation, changes in the internal value of currencies, and wage-level variations are factors which demand the attention of those who would be informed on prospective market trends. Crop conditions, pending tariff and taxation measures, changes in the policies of banks of issue, are all very pertinent and indicate more or less accurately what may be expected of a market.

The exporter who contemplates an important sales campaign in a certain foreign country, for example, may incur considerable expense without commensurate return, because he does not know that conditions in the agricultural and cattle industries in that region have been discouraging and that business commitments have been curtailed.

One Crop Doesn't Make a Country

Similarly — to take a specific case — an American manufacturer of cotton textiles, upon learning that the Turkish cereal grain crop has been poor, may decide that Turkish purchasing power will be so diminished that the market does not warrant attention. Such a conclusion completely overlooks the fact that Anatolia's principal money crop, tobacco, was larger in 1924 than ever before. Probably some of his competitors have realized its significance.

Labor costs in Germany are at present so low that some American manufacturers are disposed to become more discouraged at their inability to meet German wage levels than the actual situation justifies, and lose sight of conditions in German industry that offset the wage advantage. The informed manufacturer knows that labor costs, however important, are but one item, and observes the movement of German interest rates, taxes, external raw material prices, and other factors in production costs which more than warrant his efforts to compete with German goods.

No aspect of the reorganization now under way in Europe is of greater significance than the effort toward stabilized exchanges. The exporter who would anticipate developments in future exchange must follow more than actual fluctuations in the exchange market. Treasury reimbursements to banks of issue, contraction of currency circulation, budgetary surpluses, transition from an unfavorable to a favorable balance of trade are all strong indications of forthcoming upward curves in exchange values. The Danish crown, for example, has recently appreciated, as was to have been expected following recent improvements in the condition of the Danish Bank of Issue, with declines in loans, strengthening of foreign exchange reserves, and the acquisition of a $40,000,000 credit in the United States.

Occupations of British Emigrants

Nearly one-half, or 48.6 per cent, of the British immigrants eighteen years of age and over entering the United States during the three-year period, 1921-1923, were skilled industrial workers, according to the British Board of Trade, and reported by the National Industrial Conference Board, New York. Laborers not in agriculture or transport, that is unskilled labor, constituted nearly one-fifth, or 18.9 per cent, of the total. Other occupations represented by these immigrants during this period were persons engaged in commerce, finance and insurance, 10.7 per cent; agriculture workers, 8.5 per cent; workers in transportation and communication, 3.9 per cent; professional occupations, 2.9 per cent; and others, 7.4 per cent.

Of the total number of male emigrants eighteen years of age and over leaving the British Isles during this three-year period, 35.9 per cent represented skilled industrial trades; 19.2 per cent agricultural occupations; 12.8 per cent commerce, finance and insurance pursuits; 13.1 per cent laborers not in agriculture or transport; 5.3 per cent professional occupations; 3.9 per cent occupations in transport and communication, and 9.8 per cent other trades.

Slightly over one-half, or 53.3 per cent, of the skilled industrial workers leaving the British Isles during this period went to different parts of the British Empire, while 44.9 per cent came to the United States. Of the laborers not in agriculture or transport, that is unskilled labor, 51.8 per cent emigrated to the British Empire and 41.8 entered the United States. By far the greater portion of the agricultural workers, however, namely 84.6 per cent, emigrated to different parts of the British Empire, while only 14.6 per cent came to the United States.

From 1921 to 1923 inclusive, 21,789 workers in the metal and engineering trades emigrated from the British Isles to other parts of Great Britain. This represented 50.3 per cent. There were 20,277 metal and engineering workmen or 46.9 per cent who came to the United States, the others going to other countries.

Erratum

On pages 382 and 383, Vol. 62, of the *American Machinist*, the Farrel Foundry of Waterbury was credited with photographs and data showing the building of sugar mill machinery. They should have been credited to the Farrel Foundry & Machine Co. of Ansonia, Connecticut.

Special Tooling on Railroad Injector Work

By Strickland L. Kneass
General Manager, Injector Department, William Sellers & Co., Inc.

Some of the methods devised for manufacturing injectors and injector parts on an economical basis—Utilizing standard machine tools by means of special tools and fixtures

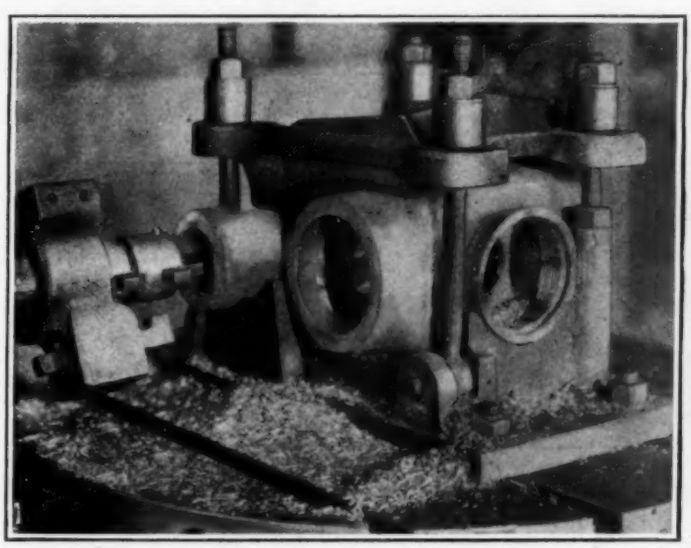
AMONG the problems which confront every manufacturer is that of determining whether or not special machines are most economical for certain parts of the work. The decision, if it be sound, must be based on far more than the actual time taken to produce the piece by either method. The manager must consider initial investment or first cost, floor space, probable depreciation and availability for other work should it be necessary to change the design of the parts being manufactured.

Bearing these points in mind, the plan of utilizing standard machine tools by means of special fixtures seems to be best for most shops manufacturing in average quantities. The injector department of the William Sellers Co., Philadelphia, Pa., has built up its manufacturing methods on this basis. Some of the methods used are illustrated herewith, showing tools and fixtures which have proved very satisfactory both as to the quality and quantity of work produced.

An injector body is about as awkward a piece to hold in a chuck or fixture as we find. It must be held in jaws formed not only to grip the irregular contour but to so distribute the pressure as to avoid crushing or springing the brass casting.

A very satisfactory holding fixture is shown in Fig. 1, where the injector body rests in the formed jaws in the lower half, both for centering the outlets and holding the work during machining. The upper clamp is rather cleverly designed to bear on the body at the desired points and also to be quickly handled in setting or removing work. The clamp has four U-shaped ears so that it can be slipped into place or removed as soon as the nuts are loosened. The two bolts nearest the head of the machine drop out of the way for ease in loading and unloading. The fixture is mounted on a rotating table on a boring machine so that the injector body can be indexed from one position to the next, as well as moved across the bed to bring different openings in line with the spindle. Special tools and cutter heads are used for each opening, one being shown in position in Fig. 1. The tool head shown bores and counterbores inside the casting and faces the end. It also turns the outside ready for threading, by means of a sweep cutter. The front end of the injector body has already been bored, faced and tapped.

The awkwardness of an injector body, from the machining point of view, is still further illustrated in Fig. 2, where the boring of a hole at an angle to the center line is in progress. As can be seen, the end of the body is screwed on to a chuck which is held at the proper angle to bring the angular hole in line with the lathe spindle. This screw chuck is made adjustable



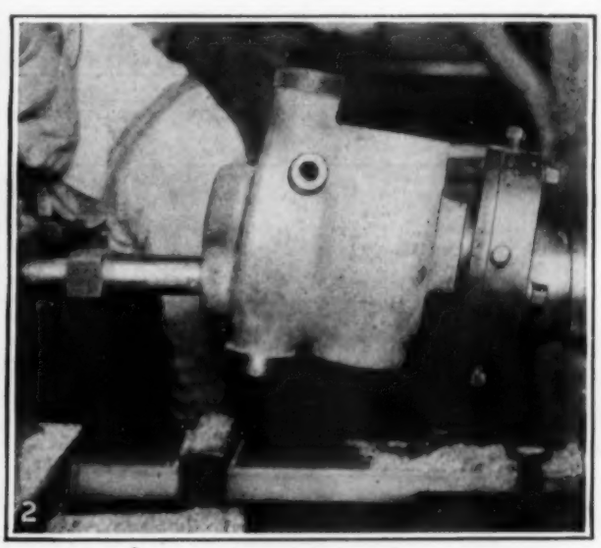
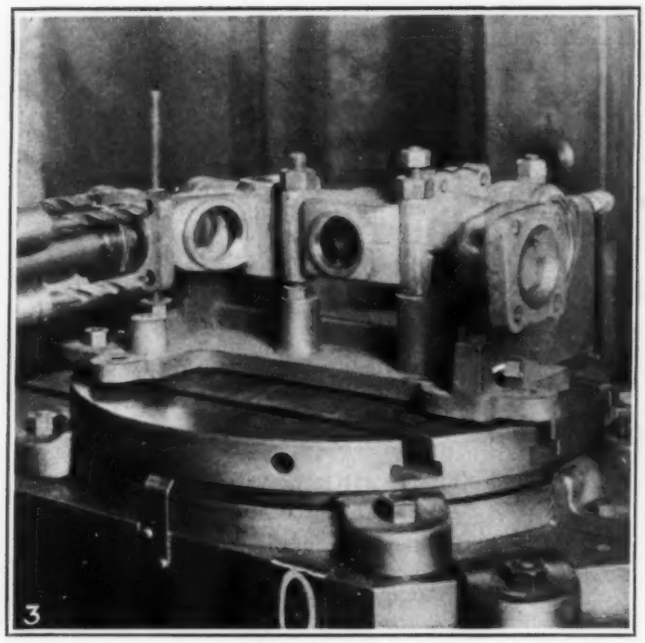


Fig. 1—Finishing injector body on boring machine. Fig. 2—Fixtures for drilling injector body flanges



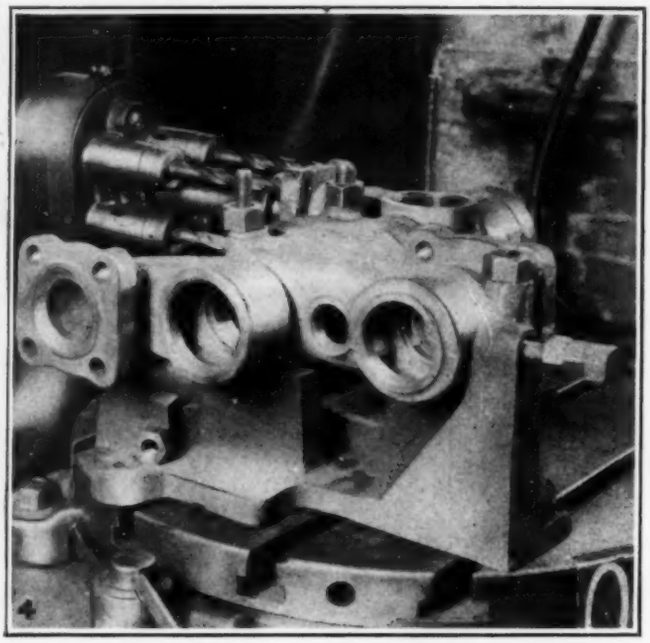
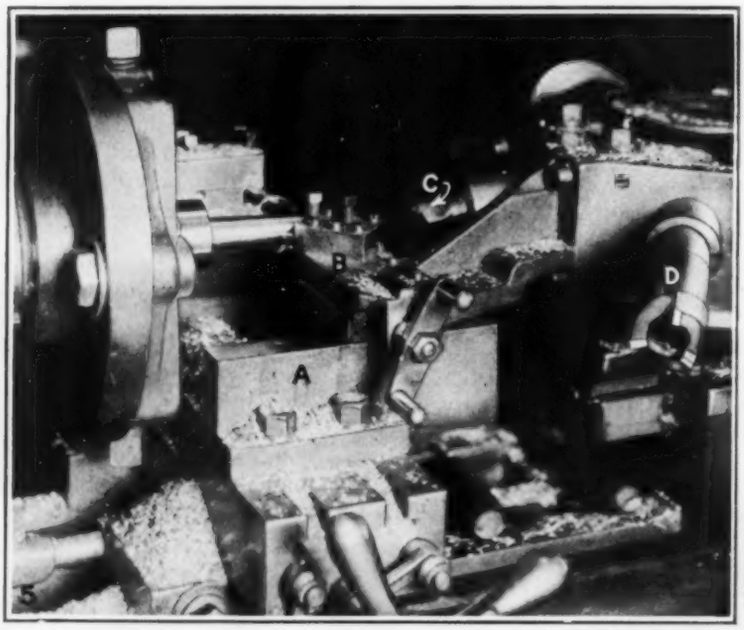


Fig. 3—More details of the fixture. Fig. 4—Wobble chuck for angular holes



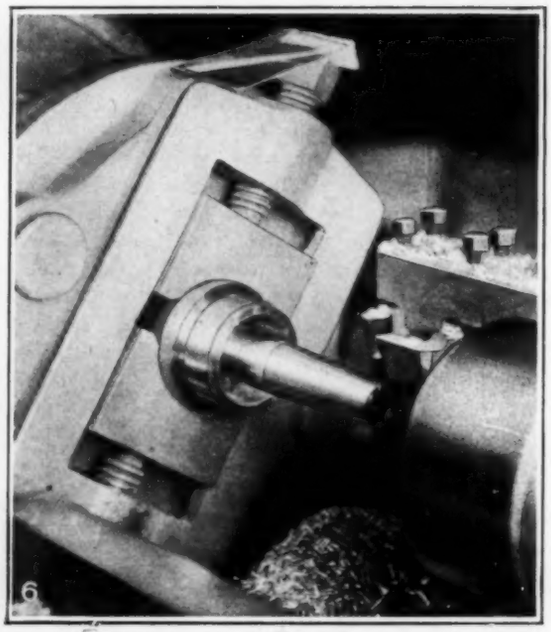
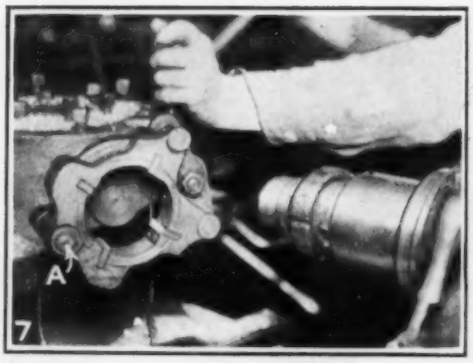
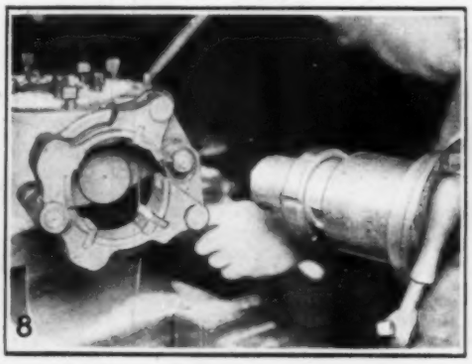


Fig. 5—Special tools for taper turning and recessing. Fig. 6—Using the back tool slide





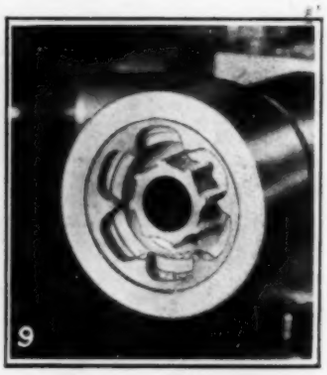


Fig. 7—Simple opening die in cutting position. Fig. 8—Die opened after backing off. Fig. 9—Combined tap and die

so that the center can be shifted whenever necessary.

Another boring-machine operation is shown in Figs. 3 and 4. It is the drilling of flanges in another type of injector body. Here the body is held by bolts which go through the cored bolt holes by which the injector is supported on the locomotive. The hole has been bored and faced with another tool. The multiple drill-head is put on the spindle and the four bolt holes drilled at once. No guide plate is used for the drills but the substantial pilot shown enters the hole just before the drills get to work. This pilot is held against the work by a spring so that it goes back into the head as the drills feed through the flange. Fig. 4 gives a better idea of this type of body and the problems presented in machining it. As will be seen, there are three flanged outlets beside numerous other openings. All of these are machined on this machine and fixture, utilizing the combined rotary and cross movements of the table to bring the different openings into position.

Another interesting tool development is shown in Figs. 5 and 6, where one of the injector tubes is being machined in a turret lathe. The end of the tube has a holding piece which is gripped in the special two-jawed chuck. This chuck is simply a special, yoke-shaped casting that is bolted to the face plate of the lathe and holds the casting firmly with little overhang from the spindle.

Tools for an Injector Tube

The shape of the tube when practically finished, is shown in Fig. 6. It involves the use of several interesting tools, shown in Fig. 5 and in Fig. 6 as well.

A special fixture *A* on the front of the cross-slide, supports a turning tool slide rest *B*, that is bolted to one face of the turret. This slide carries a tool that turns the taper to the proper angle, being guided, as well as supported by the fixture shown. The same face of the turret carries a boring tool *C*, a hole having previously been drilled.

After turning and drilling, the recess under the large diameter, Fig. 6, is cut with the hollow mill *D*, that is almost a trepanning tool. The turning and grooving of the large diameter for thread relief is done with form tools in the rear tool post in the cross slide, Fig. 6. This view also shows the chuck in more detail than is shown in the other illustration.

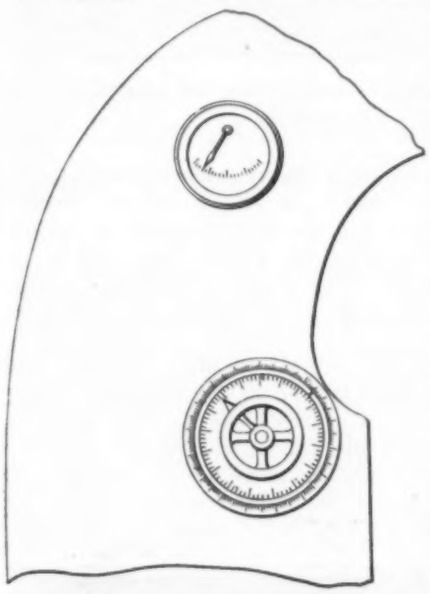
A simple but effective form of opening die has been devised for some of the operations on brass and is shown in Figs. 7 and 8. The two die-carrying jaws are pivoted at *A*, the movement of these jaws being controlled by a cam lever in the operator's hand. A cross bar at the back supports the jaws and allows a large amount of room for the escape of chips. The die is shown open in Fig. 8, with the cam lever in its lower position. It will be seen that the open ends of the jaws have a tongue and groove so as to lock the ends firmly when in the closed or cutting position. This insures keeping the chasers in their proper position so as to maintain the alignment or "tracking" of the threads. These dies have been found very satisfactory for brass work.

An unusual threading tool is shown in Fig. 9, it being a combined tap and die. It is used in threading a part which requires a thread on both the inside and outside of the piece. The thread is short, both inside and out, the die starting to cut before the tap. Both threads have the same lead. In this particular job the combination has proved both accurate and rapid.

Direct Control of Cutting Speeds

Recent machines built by Siemens-Schuckertwerke, Siemensstadt-Berlin, Germany, have the motor fitted in the pedestal of the machine, to get the motor out of the way and to protect it from damage. A special feature is the use of a cutting-speed indicator that controls the speed of the motor. This is mounted on the column of the machine and has three scale rings. The outer ring shows the cutter diameters, the middle ring the cutting speed and the inner ring the r.p.m. of the spindle. The middle ring is movable and has marks indicating whether the machine is in direct drive or in back gear.

The inner ring is set to the cutter diameter and the handle turned until the pointer indicates the desired cutting speed. This automatically cuts in the proper resistance on the regulating starter in the column, for direct current motors. With a 2.5-kw. motor, a speed range of from 15 to 350 r.p.m. can be secured with only a single gear change. The device is shown in outline in the accompanying illustration.



Regulator and ammeter on machine

The builders are also using a three-phase a.c. motor for machine drives. Changeable pole connections and special switches effect the desired regulation. Starting, stopping and speeds in both directions are secured by a single handwheel on the carriage apron or other convenient location. With a two-speed motor, 32 cutting speeds are available through suitable gearing. The motor reverses easily and quickly.

Although the regulation of the speed and the degree of efficiency of the a.c. motor are not quite equal to that with a d.c. regulating unit, this drawback will be counterbalanced by the high factor of working safety and the high torque of the three-phase motor. In addition to this, no special transforming is required with three-phase current. The utilization of the material is also so satisfactory, that the entire machine, including the electrical equipment, will not be more expensive than if built for belt-drive.

Deep-Hole Drilling

Drilling deep holes in any substance is mostly a question of removing chips and preventing heat. In some cases, such as in drilling celluloid, it is very difficult to drill over 3 or 4 in. in depth with small drills without having the material melt in the hole and clog the drill. Some mixtures of fiber and rubber act in a somewhat similar manner.

Methods of Machine Tool Design —Discussion

By Tell Berna

The interesting article, by A. L. De Leeuw on page 233, Vol. 62, of the *American Machinist*, outlines in useful form some of the important and essential considerations in using gibs. It brings to mind a modification of the taper gib, as it is used by the G. A. Gray Co. on its

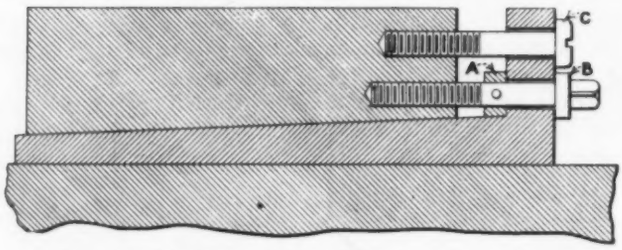


Fig. 1—Diagram of Gray "twin-purpose" gib adjustment

planers, that is applicable to many other machine tools.

This modification, which is known as the "twin-purpose" gib, is used for the dual purpose of taking up wear and for clamping the sliding part rigidly to the stationary member. The design is indicated in the diagram, Fig. 1, to show the principle on which it operates.

The head of the gib is held in place between the washer *A* which is taper pinned to the adjusting screw *B*, and the head of the screw itself. This head is squared to fit the tool adjusting crank so the operator need not look for a wrench to move it. A partial turn will force the gib either in, to bind tightly, or out to loosen it. Because of the slight angle of the taper on the gib and the fine pitch of the screw, a considerable clamping pressure can be obtained with but little pressure at the crank.

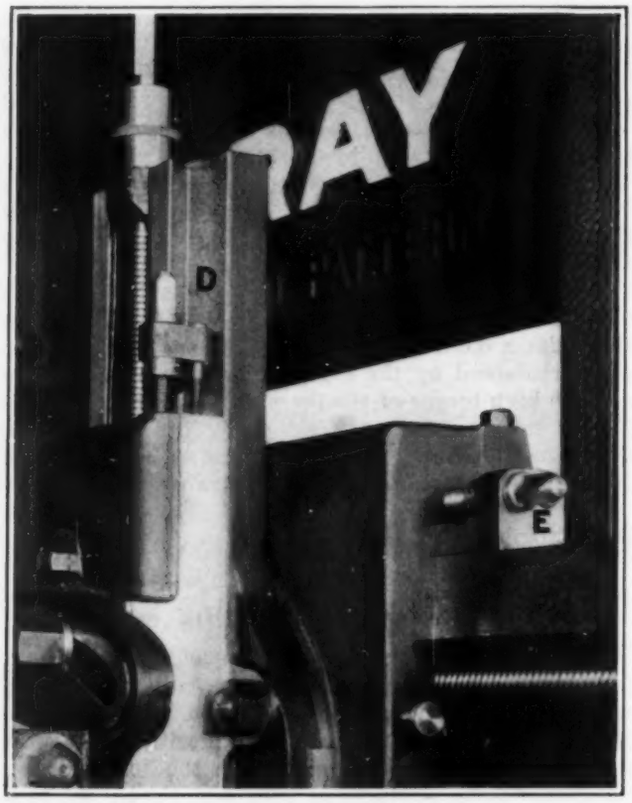


Fig. 2—Application of gib adjustment on Gray planer

The outward or loosening travel of the gib is limited by means of the cap screw *C* which is set for the proper running position. As the parts wear this screw is adjusted inwards till any looseness is removed.

In cases where the operator wishes to tighten the slide sufficiently to eliminate any tendency to move while cutting he uses the adjusting wrench to force the gib inwards.

Two applications of this arrangement are illustrated in Fig. 2, showing the Gray planer so equipped on the slide at *D* and the saddle at *E*. In this application the taper gib is used on a dovetail surface but the same idea is applicable to ordinary conditions. The arrangement is patented.

Back Shop Notes

By Frank C. Hudson

Milling is undoubtedly making headway in railroad shops. There is an increasing use of milling machines on connecting rod and other work where steel is the material to be considered.

When it comes to rod brasses the shaper seems to hold its own against all comers. The milling-machine advocates have never made much headway against the shaper in this work, although in some places they have succeeded in replacing it. Some advocates of milling, even among the shop executives, admit that they have not succeeded as they had hoped.

The difficulty seems to lie in the cutters, which do not stand up as one might expect on brass work. This brings us back to the hardness of the metal, and here the milling machine runs into a snag, for the metal seems to meet the requirements so far as a bearing is concerned—and that is the main thing to be considered. It is far cheaper to spend a little more time in machining a rod brass made of a satisfactory bearing metal, than to have a train delayed and a locomotive out of commission.

There are, however, a few roads on which milling seems to be used successfully for this work. It would be both interesting and helpful if some of the men responsible for securing these results would tell us what cutters they use, the rake and clearance of the teeth, the speeds, feeds and lubricant used, if any.

Just as a starter along this line and to give a basis for discussion, I may mention the cutters used by one manufacturer, who has had considerable experience with this sort of work. He has found that cutter teeth having a top rake of from 7 to 10 deg. and a clearance of from 20 to 30 deg., gave good results in most cases. It has also been found advisable to give the teeth a shear, or spiral, of from 7 to 10 deg., thus making an easier and cleaner cut than can be obtained with the square cutting edge.

These angles refer to high-speed steel cutters for use on brass as well as on steel. In this maker's opinion it is a waste of time to use carbon-steel cutters, even on brass, as the longer life of the high-speed steel cutters pays, even without an increase of cutter speed. The increase of time between the grinding of cutters, which means tying up an expensive machine while the cutters are being ground or changed—goes a long ways toward paying the extra cost of the high-speed steel cutters.

Automotive Production

Some Ball-Bearing Boring Fixtures

By H. O. Schultz
Chief Tool Designer, Waukesha Motor Co.

Reasons for using ball bearings on bearing boring fixture—Details of bar and fixture—Action and design of a reamer for reaming bearings in place

THE crankcase boring fixtures and boring bars in use at the plant of the Waukesha Motor Co., were developed to overcome a common difficulty and have proved to be entirely successful. With the old design of fixture in which the driving end of the boring bar rotated in a plain bushing, replacement of the bushing because of wear was an all too frequent event. The bushing seldom lasted longer than two or three weeks and during the busy days one lathe hand was kept on the one job of turning and boring bushings for the various boring fixtures. There was one for each of the several types of heavy-duty truck motors built.

Maintenance expense was so high that it was finally decided to try ball bearings. The first ball-bearing bar has been in use nearly ten years and is still serviceable.

A general view of a W. F. and John Barnes horizontal boring machine with a crankcase boring fixture in place on the table is shown in Fig. 1. There is no work in the fixture but three boring bars are in position, two being driven from the left end of the machine and the third from the right end, and another bar is leaning against the table.

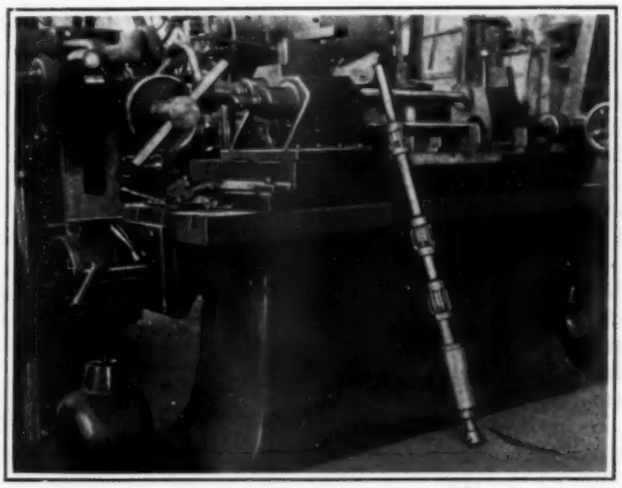


Fig. 1—Boring fixture on horizontal drill table

Details of a boring bar are given in Fig. 2. Note the two double-row self-aligning SKF ball bearings mounted on the driving end of the bar. Bearings of this particular type have been used throughout.

The pilot end of the bar rotates in a plain bushing which has been found satisfactory because it has little work to do. There are one or two points about it that should be brought out, however.

To avoid, as far as possible, the working of chips or grit into the plain bearing surfaces a steel bushing is forced into the opening in the fixture. Inside of the steel bushing is a bronze bushing that rotates. A cap fastened to the face of the bronze bushing has two lugs that engage with keyways in the boring bar. The result is that there is sliding, but no rotation of the boring bar relative to the bronze bushing, and rotation, but no sliding, of the bronze bushing relative to the steel bushing. Evidently there is something in the theory that a combined sliding and rotating motion is what works the chips into a bearing, because the separation of the two motions as accomplished in this fixture effectively keeps the dirt out.

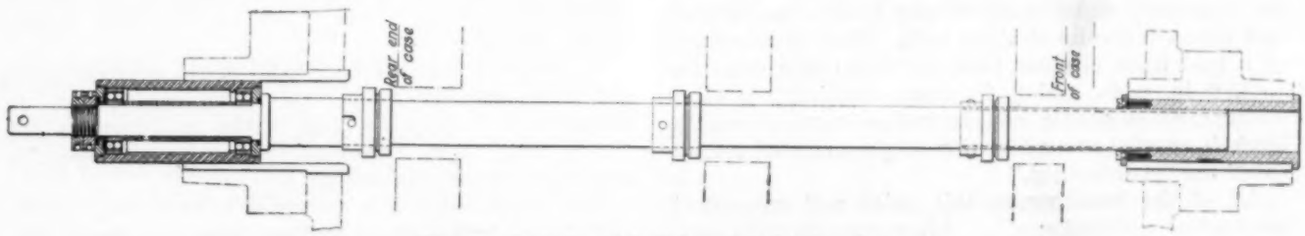


Fig. 2—Details of ball-bearing boring bar

AUTOMOTIVE PRODUCTION

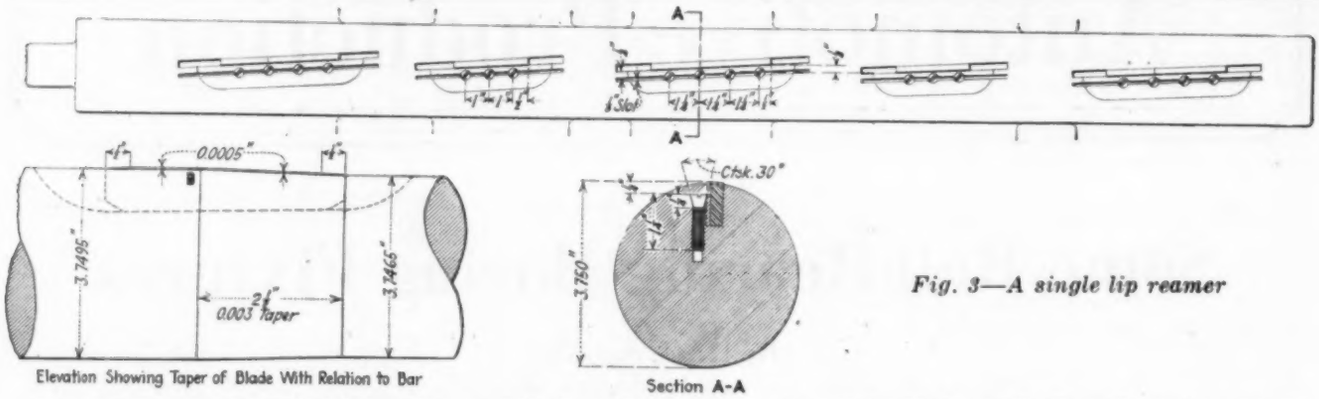


Fig. 3—A single lip reamer

The reamer used for finishing the crankshaft main bearings is illustrated in Fig. 3. It produces a hole that is round within 0.0002 in. and so close to size in diameter that no scraping or fitting is required.

It will be noticed that the single-lip reamer blade has its trailing edge on the center line of the bar while the leading edge is offset ¼ in. The full-size view of the blade shows that there is a break in the cutting edge at *B*, the portion to the left being parallel to the cylindrical part of the bar, while the section to the right is parallel to the tapered portion. As the reamer advances through the bearing the cutting action of the leading edge of the blade gradually reduces to a scraping or burnishing action at the rear end.

Preliminary to the reaming operation, there is a fly-cutting operation which is done in a fixture similar to the one already described. It is done with the bushings and caps securely assembled to the case and a few thousandths of an inch of stock is left for reaming.

No fixture is required for reaming. The case is clamped with the top side down on a boring bar. The caps are released to permit the insertion of the reamer and are again tightened over the small portion of the reamer bar which is then fed through.

Abstracts

from other publications

British Methods Of Continuous Production

Frank G. Woollard delivered a paper before the Institution of Automobile Engineers, England, dealing with the production methods of Morris engines. The machines, methods and organization described are of British development, but tribute is paid to the influence of the American machine tool makers and the American technical press.

The most interesting machine described is that for completing the cylinder block and the laying out of the works as arranged around this unit. All other units flow to meet this cylinder block, which practically does not touch the floor from the time it leaves the foundry until it is a finished engine.

The block is first unloaded by manual labor onto a grid platform where an elevator of the tray type lifts it to a storage track which forms a self-moving storage bin. This track can be extended in height to take any reasonable quantity of cylinder blocks along a track that proceeds to the pickling bath. This bath consists of a lead lined circular tank 28 ft. outside diameter, 4 ft. 6 in. wide, and 3 ft. deep, containing a dilute mixture of sulphuric and hydrofluoric acid, and the block is carried around in this in the arms of a crane called the "round-about."

All of the handling at this point and onwards is mechanical and automatic. After cleaning, the block proceeds on its way to a machine 181 ft. long, 11 ft. 4 in. high, and 11 ft. at its greatest width and weighing about 300 tons. This machine is capable of finishing cylinder blocks from the casting to the finished job, including bearing blocks, crankshaft bearings and all studs, at the rate of one every four minutes. The total time the block is in operation is 224 minutes and the total weight of metal removed from each block is 40 lb. There are 53 operation stations on this machine and 81 electric motors with a combined rating of 267 horsepower.

Mr. Woollard points out that it is not actually a single machine, but is an aggregation of simple machines attached to a continuous bed that carries all the necessary services, such as electric power and light, compressed air, etc., including a conveyor for turnings and dirt. It also has a continuous table that carries the fixtures and jigs and has one common control-shaft to time the motion of all the heads.—*Bulletin of the Institute of Automobile Engineers* (England), Feb. 10.

Brill Rail Motor Car

A description of the driving truck and power plant and of the transmission of the Brill rail motor car is given in this article. It is illustrated with photographs and drawings. The car has seating capacity for 59 passengers and can haul a trailer that will accommodate 60 more.

The drive is through both axles of the forward truck and is completely mechanical. The engine has six cylinders, 6-in. bore by 7-in. stroke and develops 150 hp. at 1,000 r.p.m. Automotive practice has been followed throughout the design.

The transmission is a five-speed combination and the car can go backward as well as forward.—*Automotive Industries*, March 5, p. 461.

Methods of Machine Tool Design

By A. L. DeLeeuw
Consulting Editor, *American Machinist*

Factors governing spindle design—Provision for takeups—Misalignment resulting from wear—Various spindle-bearing designs

THE spindle of a machine which is used for a wide variety of purposes must be built on a compromise plan. The front bearing should be made as small as conditions of lubrication permit. If the required strength, and the area needed for lubrication, do not permit of making this front bearing sufficiently small for high speeds, then one of these things must be done: either the machine must be limited to lower speeds, or else provision must be made for artificial lubrication which will permit of higher speeds and, if necessary, of higher pressures per unit area. Forced lubrication is the most common means employed in such cases.

As a rule, the length of the spindle is not determined entirely by the whim or judgment of the designer. The arrangement of driving gears, clutches, etc., generally determines the possible length and, quite often, it will be found that this length is at least as much as the designer wishes to have. When this is not so, in other words when the designer has a choice as to length, it is advisable to make the spindle as short as possible in order to be able to use a smaller diameter and thus to increase the possible speed range of the machine; and where this short length would reduce the accuracy of the machine it is better to depend on good workmanship and proper means for take-up rather than on extra length of the spindle.

When the spindle runs, and particularly under heavy loads or at high speed, there is a warming up which sometimes may be quite considerable. This heating

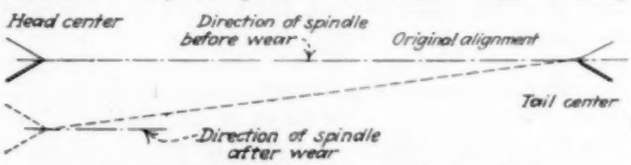


Fig. 281—Misalignment resulting as both bearings wear equally

takes place primarily at the front bearing, but the final result is that the entire spindle is hotter than its surroundings. The parts which confine the spindle against endwise movement should be so located that this heating of the spindle does not cause undue looseness in an axial direction. In some machines such looseness would have no bad effect, but on the other hand, when such looseness is possible it may happen that it is taken up while the spindle is hot and then it will be tight after it has cooled down. For instance, a milling machine spindle running at high speed, that is when working with a small cutter, may become quite warm and it may be that the work shows irregularities, poor finish, which the operator rightly ascribes to a loose spindle. If he now proceeds to take up this looseness, the spindle will be shortened and bind when the next job is being done, and this may be while the spindle is running slow and with a large cutter, or, may be, again at high speed.

In order to minimize this effect it is necessary to have the take-up on the front bearing so that the only part of the spindle which is affected by the rising temperature is that part which lies in the front bearing. This is necessarily a short length, and besides the

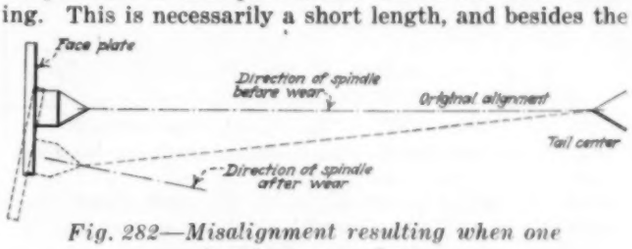


Fig. 282—Misalignment resulting when one bearing wears down

bearing itself, which is in contact with the spindle, has also heated up, perhaps not to the same extent but almost certainly nearly so. Consequently, the only difference in length there can be between a spindle and its bearing is that due to the unequal expansion of the metals of the spindle and its bearing. On the other hand, if the take-up should be between the front end of the front bearing and the rear end of the rear bearing the entire spindle expands and unless the frame of the machine should also be heated up to practically the same extent—which may be said never to be the case—the difference in length will be that between the spindle when heated and the frame at the room temperature. To give an example: imagine a spindle 36 in. long and having a front bearing 6 in. long. If the spindle should be of steel and the bearing of bronze, and if the spindle should be heated up 80 deg. F., then we have the following possible conditions:

A. The take-up is on the front bearing.

The difference of expansion between steel and bronze is 37/10,000,000 in. per inch of length, per deg. F., so that on a length of 6 in., and with a rise in temperature of 80 deg. F., there will be a difference in length of $6 \times 80 \times 37/10{,}000{,}000$ or 0.00177 in. Ordinarily, this small amount would not cause trouble.

B. The take-up is between extremes of front and rear bearings.

The expansion of steel is 63/10,000,000 in. per inch, per deg. F., so that with a length of 36 in., and a temperature difference between frame and spindle of

For the author's forthcoming book. All rights reserved. This is the twenty-fifth article of the series. The twenty-fourth was concluded on page 427, Vol. 62.

80 deg. F., there will be a total expansion of 36 × 80 × 63/10,000,000 or 0.018 in. This amount is entirely too much, except in a few rare cases where end movement is not objectionable.

There are cases where there is no choice, where conditions are such that the spindle must be held between its two extremes against end movement. Such is the case, for instance, with the spindle of a drilling machine, held in a sleeve. Such a sleeve may have considerable length on account of the required feed-stroke and it is, of course, not practically possible to have the take-up at the lower (front) bearing. Fortunately, in a machine of this kind a little endwise looseness is not harmful, and, at that, this looseness is automatically taken up by the feed pressure when the machine is at work. There are other cases as, for instance, when the spindle is mounted in an eccentric sleeve, for side adjustment. Such an arrangement makes the rear end of the

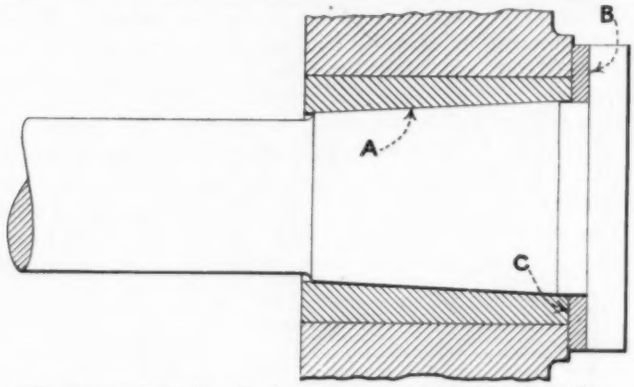


Fig. 283—Bearing design to secure endwise location

front bearing inaccessible. In all such cases it is advisable to make the spindle as short as possible.

Before going into further detail of spindle and bearing it is well to investigate the effect of looseness, either diametrical or axial, and in different classes of machine tools.

The simplest case is that of the drilling machine. In the great majority of manufacturing operations, a jig is used and the drill depends on it for location and direction, though it cannot be said that direction is *entirely* determined by the jig. The unavoidable difference in diameters of drill and jig-eye, the fact that the drill has a narrow bearing only in the jig, and the reduction in diameter of the drill make a close fit impossible. As a rule such close fit is not necessary. Mere drilling does not require it, reaming is generally done with a floating tool, making the drill spindle only a driving shaft, and boring, to be accurate, is done with a boring bear piloted at both ends, using the machine simply as a driving mechanism. Eccentricity of drill and taper hole in spindle causes, as a rule, more misalignment than the looseness of the spindle. All in all then, there is no need to exhaust one's ingenuity in the design of a drill spindle which has no looseness that cannot readily be taken up.

What has been said here applies to drill spindles running at moderate speeds. Such spindles are for the drilling of medium sized or large holes and, consequently, the spindle is of considerable size. However, spindles which run at very high speeds present a somewhat different problem. To have a 1-in. drill swing out of center 0.010 in. does no great harm, even when drilling without a jig, but this same amount might cause considerable trouble when drilling a ⅛-in. hole with a high speed machine. Besides, the centrifugal force would cause the spindle to bend badly if it were not well balanced and supported at both ends. For this reason bearings are required which permit of great accuracy of alignment, which will run with a small amount of initial looseness, and which will stay accurate, that is, which require no take-up. Ball bearings or roller bearings should be used for such cases.

Conditions are different in the lathe. Here, both diametrical and axial looseness may be very objectionable and it, therefore, becomes necessary to arrange for a minimum of wear and a convenient and accurate take-up. At first glance it might seem that the axial take-up is of not so much importance because the pressure of the cut is generally—almost always—against the headstock, so that one might think that looseness, if any, would not manifest itself. As a matter of fact, this is true in some cases and it is possible to imagine a lathe, used for some definite task, in which an axial take-up would not be required. On the other hand, lathes are used for all kinds of work and there are some kinds where the take-up is very necessary. Take, for instance, a repetition job of facing a piece of work to a given length. Expansion of the spindle during the day would require either a readjustment of the tool or a take-up of the looseness. If back-facing had to be done, take-up alone would produce a uniform job. If such a take-up is located at the rear of the spindle, a subsequent cooling would bind it.

Loose Spindle Causes Chatter

Apart from inaccuracies in the length of work, axial looseness is liable to produce chatter, though not to the same extent as radial looseness. This latter is extremely objectionable where accuracy of size, roundness, or concentricity is required.

To get the best results with a lathe which is to do accurate work, there should be an easily accessible and adjustable take-up for radial and axial looseness. The axial take-up is not so essential for heavy work but the radial one is. On the other hand, changes in radial adjustment are infrequent and do not depend on temperature.

When wear takes place in a lathe spindle bearing, two effects may be noticed. If both front and rear bearings wear the same amount, the spindle drops parallel with its original direction. In addition it is loose in its bearings. The first effect is illustrated in Fig. 281. The diagram may be considered as representing conditions either in the horizontal or in the vertical plane. The drop in the latter plane has no perceptible effect on the work, but the change in position of the head center in the horizontal plane causes the work to be turned taper. In addition the looseness will have effect on the finish, the life of the tools, and the roundness of the work.

The more common condition of wear is shown in Fig. 282. Due to the unevenness of wear in front and rear bearings, the spindle has assumed a position at an angle with its original direction, besides showing drop and looseness. The effect of the two last mentioned conditions are the same as in the previous case, and, in addition, the angularity of the spindle makes it impossible to produce a plane surface by facing. It also becomes impossible to produce a cylindrical hole by boring with a stub bar. Though the conditions are much exaggerated in the diagram, they do occur and every lathe hand has met them.

The effects of wear on the work in a milling machine vary with the nature of the work and the system of cutters used. For instance, a slight angularity of the spindle is of little importance when using an end-mill but becomes of great importance with a large face-mill. Outside of some effect on the finish, a certain amount of radial looseness of the spindle is not objectionable when taking a slotting cut, but becomes extremely important with a wide slabbing cut. Again, a drop of the spindle of a horizontal machine has no effect except when an arbor with an outboard support is used. However, as a miller may be used, and generally is used, for a wide variety of jobs, provision must be made to retain a close fit and accurate alignment.

Generally speaking, bearings may be divided into straight and taper bearings. This means that the spindle at its bearing may be either cylindrical or conical. Another way to classify bearings would be to divide them into solid and split bearings. Splitting a bearing is merely a matter of convenience in assembling or adjusting. The fact that it is split does not add to its usefulness. On the other hand it may, and often does, detract from its adjustability, especially in axial direction. It is true, of course, that if a lathe spindle has dropped, it may be realigned by packing under the lower half of the split bearing, but, after all, this is not an adjustment but a repair, and not a good one at that.

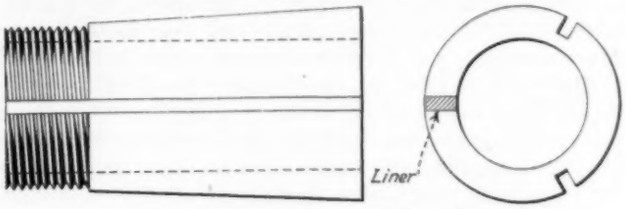


Fig. 284—A removable split bearing with taper fit to housing

A taper bearing has the advantage that radial wear may be taken up by moving the spindle endwise. It has the disadvantage that, unless the spindle is held against endwise movement, there will be either too much or not enough clearance between it and the bearing. If too much, the spindle drops and, besides, lubricant flows away. If not enough, the lubricant is squeezed out and the spindle is liable to stick. For example, suppose the spindle has a taper of 3 deg. on a side. Then it takes an endwise movement of about 0.020 in. to reduce the radial clearance between spindle and bearing 0.001 in. The amount of radial clearance necessary for good lubrication varies with the nature of the machine and especially with the condition of the oil. With ordinary machine oil, such as would be used for medium size machines—say a No. 2 miller or an 18-in. lathe—this radial clearance should be about 0.0003 in. so that if there is an axial movement of 0.003 in. the required amount of clearance is reduced 50 per cent. This shows how necessary it is to confine the spindle axially within very narrow limits.

To secure this endwise location, and also to obtain a thrust bearing, spindles are often made as shown in Fig. 283. The taper part bears in a box, or bearing, and the flange bears against a washer of the proper thickness. One way is to make the washer first and then scrape either the spindle or the bearing until there is an even bearing on both the taper part of the spindle and the flange. When this is done, packing (perhaps one thickness of ordinary paper) is placed between the washer and the frame so as to provide an oil space. It is quite difficult to scrape the taper and the bearing to a simultaneous fit and, for this reason, the following method is sometimes used: The taper part of the spindle is made to fit the bearing and then a thin lead ring or a number of small lead parts are held between frame and spindle flange while the spindle is pushed home in its bearing. Afterward the compressed lead is measured as to thickness and a washer is made to this dimension plus as many thousandths as may be required to make the proper oil space.

Adjusting Taper Bearings

When the taper part of the spindle wears or when wear takes place in the box, an endwise adjustment of the spindle is supposed to restore the proper fit. However, it is not at all certain that flange and taper will wear in the right proportion. If we suppose that the amount of wear at A is 0.001 in. and at B is 0.003 in., then we would have to move the spindle lengthwise 20×0.001 or 0.020 in., in order to restore the fit at A, whereas we should have moved it 0.003 in. to restore the fit at B. If there is sufficient packing at C, we can help ourselves by reducing this amount but, as may be seen, this means the removal of the spindle and this may be a laborious operation. The condition that the flange wears more rapidly than the taper cannot come up unless there should be an excessive amount of clearance allowed at A.

All in all, we see, then, that individual adjustments should be provided for axial and radial wear, and that, because there is no assurance that these two amounts of wear will be in the proportion called for by the amount of taper. There is a form of bearing which would automatically provide for this unevenness of wear. This is the so-called Shiele curve or tractrix. However, the mechanical difficulties of making such a bearing are so great that it is but seldom used and, then, only when the bearing is made of babbitt so that it can be cast around the spindle.

There is another difficulty in addition to the one mentioned. Until now it was silently assumed that the radial wear was even all around the spindle. As a rule this is not the case, so that the spindle drops, or moves sideways, or perhaps upward (on account of excessive belt pull), besides losing its fit in the bearing. Of course no provision can be made for a take-up and the only thing to be done in such a case it to rescrape the bearing or perhaps insert a new one.

So far the bearing has been supposed to be fixed in the frame. However, in many machines the bearing is made movable and if such a bearing is made taper—that is, with a taper fit in the frame—and if, further, it is slit, then an endwise movement of this bearing may restore the original conditions even if there has been a drop. When this construction is followed no taper is needed on the spindle.

It would seem that the last mentioned design of spindle and bearing has none of the disadvantages mentioned before. But this is not so, for the movement of the bearing relative to the spindle makes an individual axial take-up necessary more than ever.

Splitting such a bearing is done in various ways. In some cases the bearing is split completely and a liner inserted. The end of the box is threaded so that the box can be pulled endwise after the liner has been removed. When the proper fit has been restored a new liner must be put in place. Fig. 284 illustrates this construction.

Ideas from Practical Men

The department, "Ideas from Practical Men," is devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for. The rates are from five dollars upward, according to merit

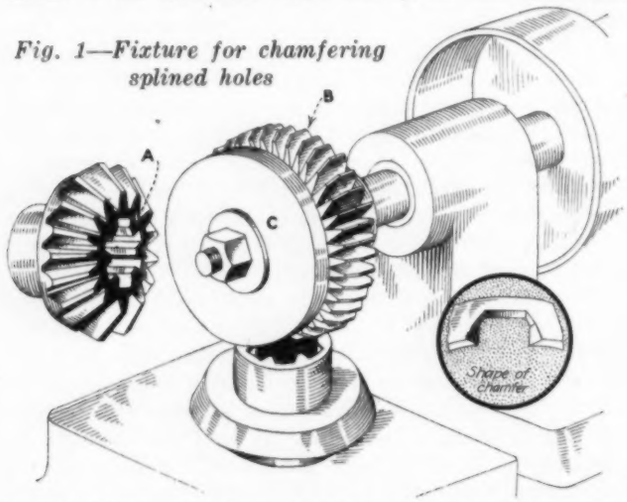
Fixtures for Chamfering Square and Splined Holes

BY A. J. QUINLAN

Chamfering the square and splined holes of side gears used in automobile differentials is a minor operation, but the writer found it to be a very costly one when done by hand. The fixture shown in Fig. 1 for chamfering the splined-hole side gear *A*, made it possible to accomplish this job about ten times as fast as a man could file the gears by hand.

The special milling cutter *B* has a face dimension about ⅛ in. narrower than the spline and is beveled

Fig. 1—Fixture for chamfering splined holes



to cut about a 45-deg. chamfer on both sides. The diameter of the cutter in relation to that of the hole in the gear is such that by feeding the work vertically upward along the centerline of the gear, the two opposite splines will be chamfered at the same time. The cutter has a large number of teeth (40), so that the work may be fed rapidly without danger of snagging.

A revolving disk *C*, which turns upon a shouldered spacing collar on the cutter arbor, acts as a depth stop by coming in contact with the gear. This stop is provided to get uniform depth of chamfer from the top of the gear. A stop working at any other point would give a deep chamfer on any gear that was a trifle oversize in the matter of length and perhaps too little chamfer one that was underwise.

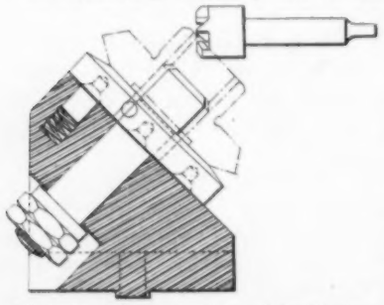


Fig. 2—Fixture for chamfering square holes

Due to the curved path of the cutter, the chamfer will be a little deeper at the inside corner of the hole. The cutter will also remove the corner at the bottom, or outside diameter, of the spline as shown by the enlarged sketch. The round part of the hole is, of course, chamfered by a countersink before the hole is broached.

The work is done in an ordinary hand milling machine. The fixture could easily be improved by making the splined stud over which the gear sets to rotate, and providing an indexing mechanism to locate the gear in the successive positions without removal from the stud.

The square-hole gear is handled on the fixture shown in Fig. 2, which has a four-station, plunger-lock, indexing arrangement. The square stud that carries the work is inclined at an angle of 45 deg. The diameter of the cutter is equal to the size of the square hole across the flat and is beveled so that it chamfer the flat portions at the corners of the hole. This fixture is also used on a hand milling machine and the work may be fed to the cutter either horizontally or vertically.

These simple fixtures have relieved the necessity for a large amount of hand work and the saving in labor, as well as the increase in production, has been out of all proportion to their cost.

Repairing Micrometers—Discussion

BY CHESTER H. FRANKLIN

The method of repairing the anvils of micrometers, shown on page 357, vol. 62, of the *American Machinist*, by H. J. Gustav Kopsch does not appeal to me as being just according to Hoyle. The anvil should be square with the axis of the screw, but as the screw or spindle is not always square on the end, the method shown will not accomplish this result.

One of my friends, who is a bug on accurate measurements, recently tested a dozen new "mikes" of a well-known make and did not find a single one with the end of the spindle square with the axis. If the spindle end is not square, the method illustrated will merely transfer the same error to the anvil. This, of course, assumes that the man doing the job has an exceptionally steady hand.

There is no question as to the desirability of having the anvil square and flat. But it certainly seems as though the accuracy desired could be obtained much more surely by having a mechanical device to hold the micrometer at a right angle to the lap or stone. Much trouble in measurements can be saved by having the measuring points really "corrected" more frequently than is usually done.

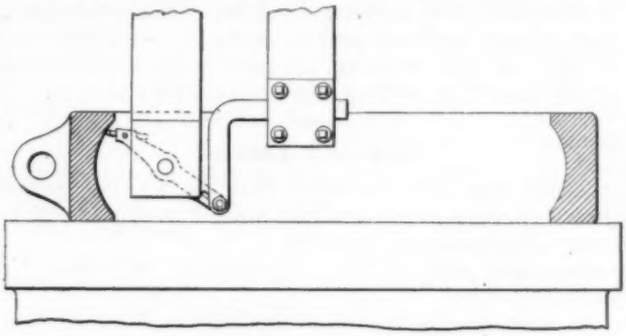
IDEAS FROM PRACTICAL MEN

Boring Straps for Round-Edged Eccentrics

BY FRANK RAMSEY

Straps for eccentrics with rounded edges can readily be bored in any double-head boring mill with the simple tools shown in the illustration.

The cutting tool is pivoted to a block held in one of the tool bars, the pivoted point being in the center of



Tools for boring eccentric straps

the eccentric strap in both directions. The tool is slotted at the rear end and is operated by a stud in a bar bent to an angle and held in the second tool bar of the machine, as shown.

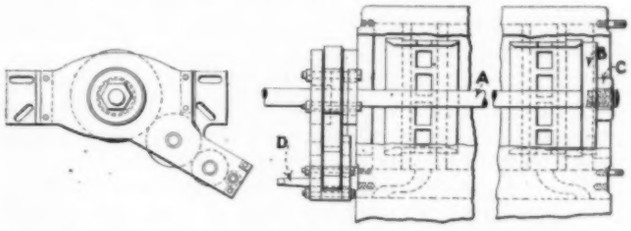
In operation, the tool bar holding the cutting tool is held stationary, while the second tool bar is fed up or down, thus making the tool describe an arc.

Devices Used in a Southern Pacific Shop—Discussion

BY C. G. WILLIAMS

In an article, under the title given above, by Howard Campbell and published on page 415, Vol. 61, of the *American Machinist*, there was shown a device for pulling valve bushings into place.

I do not think the device shown is as good as the one made by William J. Hynes when he was toolroom



Device for pulling bushings into valve chamber

foreman of the Rock Island shops at Little Rock, Ark., and which is herewith illustrated.

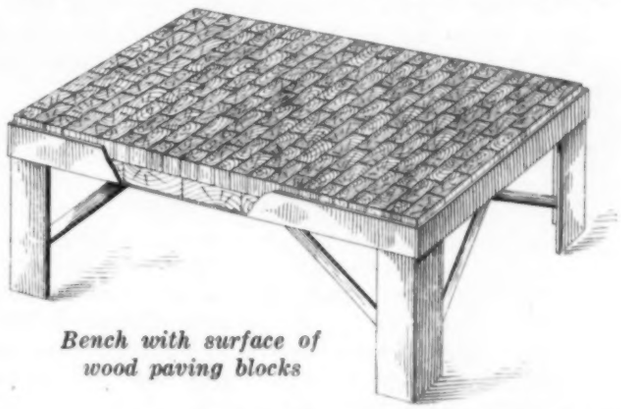
The rod *A* is 3 in. in diameter and is threaded for about half its length at one end and 8 in. at the other end. One stationary and one revolving nut, a large, heavy washer and a train of gears complete the device. In use the device is attached to one end of the cylinder by four studs. The bushing is put over the rod *A* and entered in the valve chamber. The washer *B* is put in place where it is held by the nut *C*. An air motor attached to the taper shank *D* revolves the gears and revolving nut, pulling the bushing into place. The device is then attached to the opposite end of the cylinder and the other bushing is pulled in place in a like manner.

Wood Paving Blocks for Benches

BY E. F. CREAGER

In plastic molding work the hot dies are transferred from the hydraulic presses to a bench for cooling and reloading. In our shop we found that the impact of so many dies (they are changed every fifteen minutes or so) soon converted even the best lumber available for bench construction into a splintery mass that made handling the dies difficult and caused many minor injuries to the hands of the workmen by reason of the splinters getting into their fingers. After several experiments with iron and steel facings we made the benches as shown in the accompanying sketch.

The frame and legs are made of 3½-in. angle iron welded together, as that is the cheapest and most permanent method of fastening and there are no bolts and rivets to work loose. Yellow pine planks, 2-in. thick, are then bolted to the inwardly projecting ledges



Bench with surface of wood paving blocks

of the angles, leaving a shallow tray which is filled with 2-in. wood paving blocks, tightly fitted.

This makes an excellent surface, smooth and noiseless, and does not injure the dies. Though hollow spots will eventually be worn in the surface, it is a comparatively simple matter to dig out the worn blocks and replace them with new ones.

Wood paving blocks can be used to advantage in the following manner in shops having cement floors. Wherever there is a large boring mill, planer or other machine from and to which heavy castings are continually handled, a hollow place will soon be worn in the floor at the place where the castings are most frequently deposited. Cut out the cement around the worn place to a neat rectangle, fit in a frame made of angle iron of suitable size and fill in with the paving blocks.

Always place the blocks with the grain perpendicular to the floor level. Some may think this a foolish suggestion—as I did—until someone laid a runway for trucks with the grain flatwise.

Practical Shop Problems

Questions of a Practical Nature will be answered in these columns

Tapping Smooth Threads

Q. Our lathe foreman has requested us to ask if you know any method of lubricating cast iron in tapping. His idea is that cast iron is seldom lubricated while being machined and that in the job he has in mind, tapping the holes dry, leaves the threads too rough. Do you know of any lubricant that will help us to get smooth threads in cast iron?

A. In tapping cast iron, smooth threads can be obtained by lubrication with soda water, oil or any of the various compounds used for cutting or grinding.

Rolling or Spinning

Q. In fastening the screw shell to an electrical attachment-plug, the edge is rolled into a groove. Can you tell me how the operation is performed?

A. While we are not familiar with the exact process of fastening the threaded shells to attachment plugs, it can readily be done by rolling, or spinning the edge of the shell into the groove.

If the plug is held in a chuck in an ordinary lathe, bringing a tool having a roller of the proper shape against the shell with slight pressure, will force the edge into the groove.

In place of the roller tool, a rounded tool of the proper shape and highly polished, can be used.

Gage for Lead of Screws

Q. Can you tell me where I can get a gage for gaging the lead on screws having U. S. S. threads?

A. We know of no such gage. You are probably confounding lead and pitch. The lead of a thread is the amount a screw will move endwise in a nut when turned one revolution. Pitch is the distance from the center of one thread to the center of the next.

In screws cut with a single thread, lead and pitch are the same. If cut with a double thread, the lead is twice the pitch.

Pitch gages for all forms of threads can be bought at any hardware store carrying machinists' tools.

Measurement of Circular Pitch

Q. Can you tell me of any table that will give me the center distances between the teeth in racks and gears of various pitches?

A. You will find tables giving the information you require, on pages 106 to 109 of the *American Machinists'* Handbook (third edition) and on pages 98 to 101 in the second edition.

In the tables referred to, you will find both circular and diametral pitches of gears and racks. Whichever one is given in the first column is translated into terms of the other in one of the other columns.

The circular pitch of a gear is the distance between the centers of adjacent teeth, measured *on the pitch line*, and is the same on a rack of like pitch. Please note that the center distance of adjacent teeth in a gear, as found by stepping off the distances with dividers, is *chordal* pitch and not *circular* pitch. Since the center lines of rack teeth are parallel lines, the center distance stepped off with dividers, is equal to the circular pitch of any gear that will mesh properly with the rack.

Standard Threads

Q. We have been informed that the No. 14, twenty-thread machine screw has been discontinued and will no longer be considered standard.

Can you give us any information regarding the matter?

A. According to the standards published by the General Motors Co., the No. 14 machine screw having twenty threads has been superseded by a twenty-thread screw of ¼ in. in diameter.

Grinding Scrapers

Q. Will you tell me at what angle the end of a scraper should be ground?

A. The proper angle to which a scraper should be ground, is largely dependent upon the material it is to be used upon and the man who is going to use it.

Generally speaking, if the scraper is ground with the end at 90 deg. to the top and bottom it will answer for nearly all work, though some prefer the angle to be a little greater, using the edge that is most blunt.

If the angle is less than 90 deg., the scraper is apt to dig into the work. Another disadvantage is that but one side of the scraper can be used. Taking into account the metal to be scraped, the scraper should be more blunt for soft metal than for hard.

Building a Riveting Machine

Q. Can you supply us with some data with reference to a riveting machine that we can build for our own use? It can be of either the hammer or spinning type.

A. We regret to say that we have no data that will aid you in building a riveting machine. It would seem to us that you could get about all the data needed from the catalogs of makers of such machines.

However, we believe it would be much cheaper for you to buy a riveting machine from a reputable maker, rather than to build it yourself.

Forging Drill Shanks

Q. Can you tell us where we can get equipment for making the shanks of bitstock twist drills?

A. As far as we know, there is no special machinery for making the shanks of bitstock drills. We believe they are generally forged in dies in a quick-stroke hammer of the helve type. Speed of stroke, rather than force of blow, is desirable.

Technical Abstracts

The Measure of Labor's Value

This is an interesting statistical article in which diagrams illustrate the statement that Italy's average labor, skilled and unskilled, gets 96c. per eight-hour day, the Belgian worker gets $1.00, the French, $1.36, the German, $1.46, the English, $2.28 and the American $5.60. The American leads, rising from approximately $1.00 per ten-hour day in 1910 to his present status.

The argument, therefore, arises that because of this, the United States cannot afford to maintain an open door for foreign labor—there would be far too strong a demand to bring in relatively unskilled labor.

American labor has learned that machinery is not a device designed to put men out of work, but one which lightens labor's burden and increases its reward.—*Industry Illustrated*, February, p. 14.

Maintaining Shop Motors

There are two different systems of arranging motor equipment now in general use. One is group drive, whereby several machines are driven by one motor, and there is the individual drive where a motor is reserved exclusively for the use of one machine and is usually built into the machine. With the group motor drive the motor is usually arranged so that it is free and accessible and thereby easy to maintain in proper condition. With the individual drive, however, the motor is often housed in an inaccessible position, sometimes being inside the machine installation itself. This must be considered when weighing the relative advantages and disadvantages of the two types.

K. D. Hamilton, mechanical engineer of the George E. Keith Co. goes into this question fully discussing the various points that have to be taken into account. One fact that he lays emphasis on is that in a shop using a large number of motors it is necessary to standardize on one or two reputable makes and adopt this type of equipment as final. It is surprising the saving that can be made in standardizing on one unit as this enables the store to eliminate the necessity of storing innumerable parts, saves floor space, handling and insures quick service when repairs are necessary.—*Factory*, February, p. 256.

The Philosophy of Cutting

This editorial states that we know uncommonly little about the philosophy of cutting. We have perhaps regarded it, particularly when long smooth spirals of steel have been turned from a well lubricated bar, as a gentle process of removing metal by insinuating a fine cutting edge.

Dr. Rosenhain says by microphotographs that cutting in some cases at least is a brutal process, that it compresses and distorts the metal locally, and that it rends the particles apart rather than separates them by the above gentle insinuation. So far in this philosophy, examination has been directed to the material acted upon, to the material in the process of removal and to the total forces upon the cutting tool.

As research proceeds it will be advisable to examine the tool itself. A micro-photograph exhibiting the stresses in it could not be less interesting than those showing the effect of stresses on the work. Some engineers hold that cutting takes place at the tool edge, others that the actual edge is never in contact with the work once the cut has been started.—*The Engineer* (England), Feb. 6, p. 163.

Welding Problems

Prof. C. R. Darling of the Finsbury Technical College, England, presented a paper before the British Acetylene and Welding Association, in which he stated that one of the problems facing the welder was the inability to control temperature.

It does not follow that by making metals as hot as possible the best of results are obtained, and he suggested that it would be interesting to try and ascertain whether there was some special temperature at which the best results were obtained or whether by using a temperature rather less than that of the oxy-acetylene flame the results would be better than by the use of the flame as ordinarily employed. For example, the acetylene could be mixed with some gas of less powerful character from the standpoint of the production of temperature.

He also touched on the question of fluxes and seemed to conclude that the use of such was a concession to inferior workers and that if we trained better welders and did away with fluxes altogether, it would enable us to cheapen electro-welding and lead to a much greater use of arc welding.—*The Engineer* (England) Jan. 23, p. 113.

New Aluminum Alloys

Robert S. Archer and Zay Jeffries, of the Aluminum Co. of America, gave a paper before the February meeting of the American Institute of Mining and Metallurgical Engineers in New York in which they reported on two new alloys that have resulted because of the desire to overcome some of the difficulties met in the fabrication of duralumin.

The first is an aluminum-copper alloy which shows substantially no hardness increase on ageing at ordinary temperatures after quenching from around 500 deg. C., but is susceptible to marked hardening by reheating at 100 to 175 degrees.

The second is an aluminum-magnesium-silicon alloy, which hardens to some extent on ageing at ordinary temperatures, but can be improved by artificial ageing.

Both of these types possess decidedly better working qualities than duralumin the development of which is dependent on thorough mechanical working. The alloys are available in the form of sheet, bar, rod and wire, tubing and shapes, both rolled and extruded. They are ordinarily used in the heat-treated condition and when properly heat-treated the first has a tensile strength of 30,000 to 45,000 lb. per sq.in. with an elongation of 10 to 3 per cent in 2 in., while the second alloy will have a tensile strength of 17,000 to 30,000 lb. per sq.in. with an alongation of 15 to 5 per cent.—*The Iron Age*, Feb. 26, p. 666.

American Machinist

Established 1877

KENNETH H. CONDIT AND FRED H. COLVIN, *Editors*

Wasting Money on Old Machines

MEN trained in finance are supposed to be experts when it comes to investments. They could hardly be persuaded to invest $175 in a bond that they knew could not bring over $100 if resold, when by spending a few hundred more they could secure at least a 25 per cent return on the investment.

The financial man's keenness in investments, however, seems to be confined to securities. He has, apparently, not learned that dividend-earning machinery in his own plant is as much an investment as stock or bonds in some other industry. It is usually much safer in his own. For the earning power of all industry is based on the economical production of machinery of some sort.

A machine builder recently received an order for a new spindle for a very old machine. As its cost would be high he saw the shop manager, feeling sure that a mistake had been made. He could not imagine the spending of $175 to repair a machine that would not sell for over $100 after the repair was made.

But the manager knew all about it. He knew he was throwing away money. But he had to have the production from this machine, and the man-with-the-check-book had issued an ultimatum that no new machines were to be bought. And this was not a railroad shop where similar economies have been a common occurrence for many years.

Financiers in charge of industrial plants seem to class machinery as an expense, while bonds based on the earnings of the same machinery is considered an investment. There is room for a little education in college courses in economics.

The New Floor Leader

THE public record of Representative John Q. Tilson, the majority floor leader of the new House of Representatives, is an exceptionally good one from the point of view of the metal manufacturing industry. As chairman of the sub-committee that handled the metals scheduled in the Fordney tariff bill, he secured a higher rate of protection for the products of the machine shop than ever before had been obtained.

Mr. Tilson has also to his credit the initiation of the idea of having a National Screw Thread Commission. He has urged consistently that the Ordnance Department be adequately equipped with tools and gages sufficient to take care of munitions manufacture in case of an emergency. At the same time he has been strong for the limitation of actual munition production to the bare amount necessary to keep together the mechanics who would be the nucleus of an expanded force in case of trouble.

If there were more men like him in Congress there would be much less likelihood of the passage of ill-considered and dangerous legislation.

No Hardeners Wanted

ANOTHER instance of the way in which science is superseding rule-of-thumb practice is given by the statement from the head of the heat treating department of a big plant that he hires no hardeners. He prefers men with mechanical training and teaches them what they need to know about their work which is under the control of trained metallurgists. His slogan is "Fewer men and better ones."

His department is fully equipped with conveyors and machines, many of them automatic or semi-automatic, which require better men to handle them although not so many men as in the ordinary hardening room. The methods employed are so different from those in use a few years ago that the regular hardener, used to rule-of-thumb procedure, has too much to unlearn for him to be a useful employee in the department.

Just Suppose

JUST suppose a man came to you and offered you a new power plant which would cost you only $75,000 and which would save you in coal and labor $15,000 a year. And suppose he showed you, not only by figures but by the experience of others, that his statement was truthful and conservative, would you not consider the proposition most carefully, and, if you found that you could actually make 20 per cent on your investment wouldn't you beg, borrow or steal the money, if you did not have it lying ready and waiting for you in the bank? Of course you would.

Now suppose somebody comes to you and offers you a new machine tool, for a mere $6,000, that will do away with the labor of one man, costing, say $1,500 a year. Wouldn't you also be ready to beg, borrow or steal if you didn't have the cash, seeing that here is a chance for a 25 per cent return?

Hold on, you say. A power plant is one thing and a machine tool something entirely different. Coal is getting expensive and a machine tool can always be doctored up some way, and, anyhow, a nice power plant is something to show visitors.

Well, maybe, but—

Just suppose.

Shop Equipment News

Cincinnati "Hypro" Planer

Designed with regard to modern machine tool requirements, the "Hypro" planer announced by the Cincinnati Planer Co., Cincinnati, Ohio, embodies interesting and important improvements to the company's standard line. Points involving strength of construction, adaptability for rapid manipulation with provision for safeguarding all movements and design to produce continuous service ability have been featured.

The bed and table are of box construction and are ribbed in both directions, the bed being fully inclosed while openings in the sides of the table connect at intervals to the bottom of the tee slots to permit of keeping them free of chips. The bed is double the table length so there is no table overhang at maximum stroke. It is also fitted with guides between the Vees on each side to absorb the side strains set up by heavy cuts and eliminate any tendency of the table to lift up the sloping sides of the Vees.

The housings are built with wide faces and are designed so that the thrust of the side-head tools is taken on a square section with metal to metal contact. A box-type arch ties the housings together at the top. The dovetail design in the heads is inverted from that usually employed to obtain a heavier cross-section through the center. This design also causes the bearings to tighten against the ways when work is being done. Herringbone gears are used in the drive and all gears including the table rack are made of steel. The gears in the bed are integral with their shafts which rotate in ground bearings.

The general appearance of the machine is illustrated in Fig. 1, which shows the planer arranged for direct reversing-motor drive with the motor mounted on the side away from the operator. A detail view of the operator's side is shown in Fig. 2 and gives a good idea of the extent to which the design has been carried to provide adaptability for rapid manipulation combined with safeguarding of each movement.

The three levers, *A*, *B* and *C* are the head direction controls. *A* is for the traverse of the left-hand head, *B* is for the vertical travel common to both heads and *C* is the duplicate of *A* for the right-hand head. These levers have three positions, in toward the planer to move both the heads down and either one or both away from the operator, up straight for neutral and no head movement, and out from the planer to move both heads up and either one or both toward the operator. The horizontal-travel lead screws and the vertical-travel splined shaft project from the head at *D*, *F* and *E* respectively and are squared so they may be operated by hand. The feed is set by the feed adjusting knob *G* and is connected when desired by turning the small feed engaging levers *X* at the base of each shaft.

Safety-stop levers, as shown at *H*, are provided on both rail heads to automatically stop further movement at the limit of head-travel outward or toward each other, should the operator set them in motion and neglect to stop them himself.

Levers *J* and *K* control the rapid motions of the rail and heads, and interlock with the side-head lift-lever *M* through the ratchet segment *N* so the rail and side head cannot be run into each other. Automatic stops further guard the rail movements at the extremes of its travel.

The detachable crank *L* controls a locking device between the rail and the planer housing, one turn operating a powerful toggle to pinch clamps *A-A* against the housing as illustrated in Fig. 3. This movement interlocks with the rail-lift control so it then becomes inoperative.

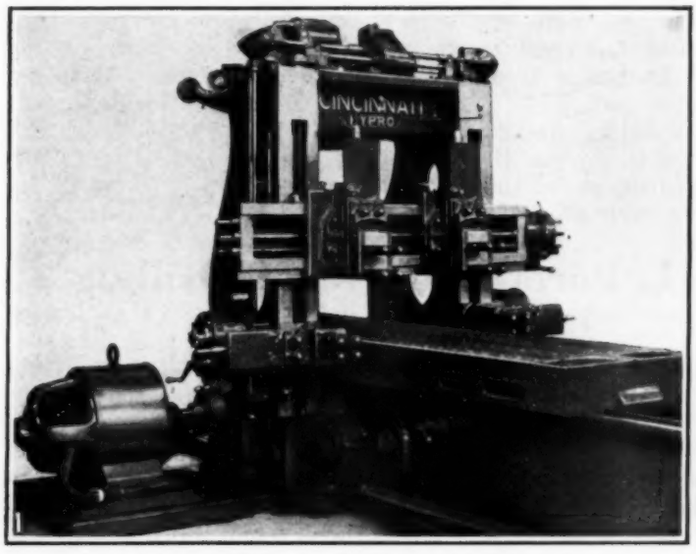


Fig. 1—Cincinnati "Hypro" Planer

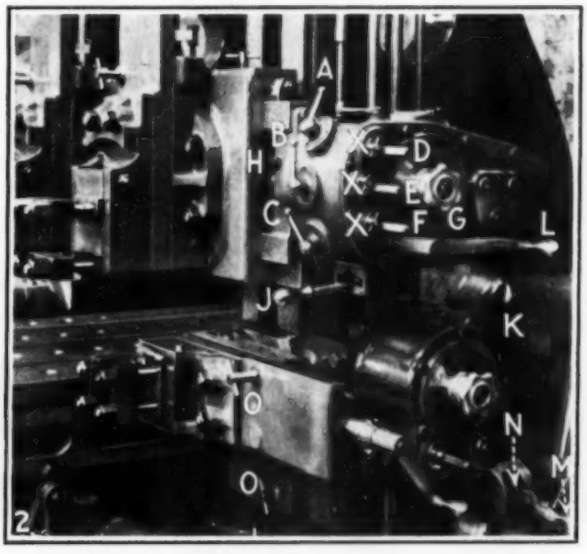


Fig. 2—A detail view of the operating controls

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Lever *M* operates the side-head lift. *N* is the safety interlock and travel limit as already mentioned between side head and rail. Hand clamps *O* are provided to lock the head slides and the side heads.

In short, all movements and settings can be made from the operator's position, by hand, by power feed or by rapid traverse as he may elect, without fear that he may get hold of the wrong lever or forget to stop a movement he may have started.

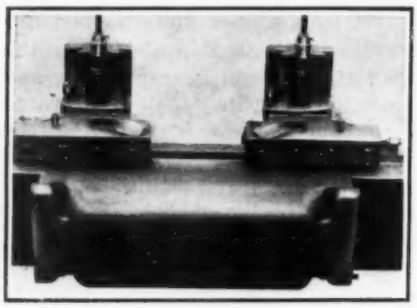

Fig. 3—A rear view of the rail

Aside from strength of construction, selection of proper materials and provision for safeguarding manually set motions, continuous service of any machine tool is largely dependent on lubrication. In the case of the Hypro planer, the engineers have adopted the continuous principle as the best means to cover this point and have applied it in units to the different parts of the machine.

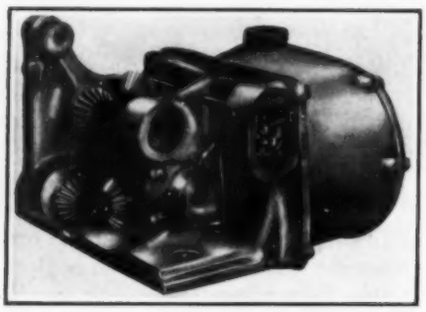

Fig. 4—A control head partly dismantled

A geared pump is provided in the base which picks up oil from a drain tank, passes it through a strainer on the pressure side and forces it into the Vees below the table near the center of the bed, into chambers around each of the drive bearings, and into spray nozzles located above and directed at the driving gears.

From its point of entrance to the Vees, the oil is pumped through channels the full length of the table, thoroughly lubricating the ways and returning to the tank through strainers at either end of the bed. From the chambers around the bearings, it is forced through felt wicks to further cleanse it and then into the bearings. Holes lead upward from each of the bearing oil chambers into the channel in the Vees, further augmenting the supply there and acting as a flushing medium, to wash out any small particles of grit that might collect, carrying them to the strainers previously mentioned. Notches are also cut on the outside of the bearings to return excess oil to the tank. From the spray nozzles the oil floods the gear teeth and drips off to the tank.

The tank is arranged to form a settling basin for sediment so it is not picked up by the pump, and a gage on the back of the left housing shows the level that is being maintained.

Hollows of sufficient size for a ten-day supply of oil are cast in the elevating mechanism, at the ends of the rail and in each of the work heads. A cover plate protects the oil from dirt. Holes are drilled from these hollows and fitted with pipes where necessary and with wicks to convey a regulated amount of oil to each local wearing point. These hollows in the vertical heads are illustrated in Fig. 3, while in Fig. 4 one of the control assemblies is partly dismantled to show the reservoir, the pipes and the wicks leading to the parts that need lubrication.

Maintenance has been considered by making the working parts accessible for inspection through subassembly unit removal that will not interfere with other units and that will consume the least possible time.

Other refinements of design include the safety locking feature incorporated in the table control to hold it in neutral and the two-speed belt-drive control by which two speeds forward with a constant-speed return are selective through a shift lever.

The machine is built in sizes from 36 in. heavy to 72 in. standard, inclusive.

G. & L. Portable Universal Drilling Machines

Two lines of universal machines have been put on the market by the Giddings & Lewis Machine Tool Co., Fond-du-Lac, Wis., to meet particular needs. They have the feature in common of being portable so that they, rather than the work, can be moved, adjusted and set in progressive positions. They can be set on runways under their bases or can be picked up bodily and moved to another location.

The machine illustrated in Fig. 1 is known as the G. & L. Boiler and Fire Box Drill in that it is particularly adaptable to that sort of work. In addition it is suited to many different kinds of work where it can be brought to the job and put directly at drilling, boring or reaming.

It consists essentially of three main parts, the base or truck, the column, and the drill spindle unit.

The base is machined to take the column on dovetail ways and is provided with a rack for changing the position of the column. Four jacks are secured to the side frames to take the weight of the machine and steady it for heavy duty drilling.

The column is of hollow construction and is turned and ground to fit the drill-spindle unit. It is provided with a foot which is machined to fit the dovetails on the base.

On the smaller of the two sizes, which comprise the line, this foot is rigid with its column and has a lever and gear arrangement to engage with the rack on the base for moving the drill. In the larger size this movement is controlled from a hand wheel carried on the drill-spindle unit. In addition, a ratchet lever, pinion and segment permit swinging the column 30 deg. each way.

The drill-spindle unit is counterweighted as shown and has a range of vertical adjustment from 24 to 84 in. above the floor on the smaller size, while on the larger the range is between 31 and 100 inches.

The 1,800 r.p.m. driving motor is mounted on the spindle unit and connects to the source of power through

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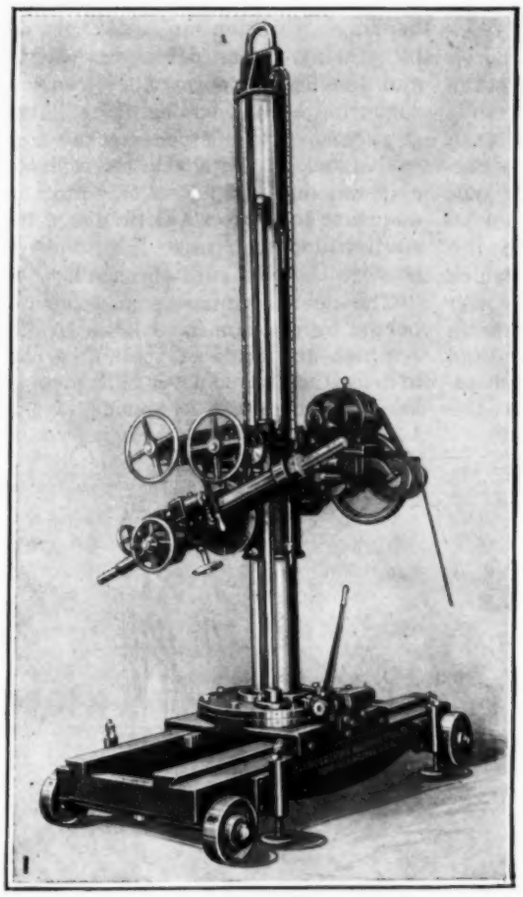


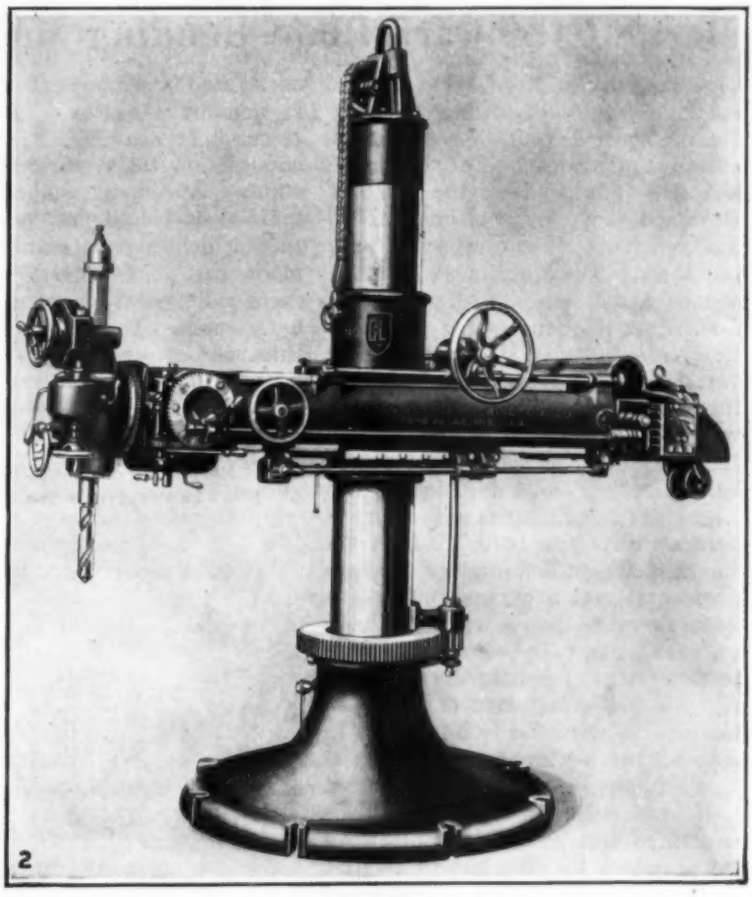


Fig. 1—G. & L. Portable Universal Boiler and Fire Box Drill. Fig. 2—Portable Universal Radial Drilling Machine

a reel that carries 30 ft. of cable. On the smaller machine 3 hp. is recommended to drive the spindle to its capacity, which is 1¼-in. diameter for drills, increasing to 3-in. when cutter tools are used, and 1¼-in. tap.

The spindle can be elevated or depressed out of horizontal a maximum of 30 deg. Clamps are provided on all adjustable points for securing any setting. The spindle is fitted with Morse taper, and has a maximum travel of 18 and 24 in. respectively.

On the smaller size there are four spindle speeds and one power feed. The larger has six speeds and two power feeds. Controls are conveniently located and designed to be manipulated without effort. The machines weigh 4,000 and 9,500 lb. respectively including the truck. In the event that stationary ways are specified these weights increase to 4,500 and 10,000 pounds.

The other portable machine illustrated in Fig. 2 is an adoption of a radial drill with interesting universal features to a portable arrangement. It is known as the G. & L. Portable Universal Radial Drilling Machine, and is designed for miscellaneous drilling, boring and tapping. It can be set to work in any plane and directed into corners unusually hard to reach.

There are four sizes whose capacities range from 1⅛ in. in cast iron, 1¼ in. in steel and 1¼-in. tapping, to 3 in. in cast iron, 2 in. in steel and 2½ -in. tapping, and whose speeds and feeds are arranged to give ample choice.

The two smaller sizes may be mounted on the same truck which is used for the fire box drill or on stationary ways to specification. The two larger machines are beyond the point of proper truck mounting and are therefore furnished with either the round base as illustrated or set on stationary ways. The motor is mounted on the box-type arm in all cases, belt-connected on the two smaller sizes and geared direct on the others.

The reason for the wide range of adaptability of this style of machine for miscellaneous work lies in the number of adjustments between arm, work-spindle and base.

The arm can be adjusted up or down, can be rotated completely around the base, can be adjusted out of horizontal by 20 deg. either up or down, and can also be moved longitudinally to increase or decrease the distance between spindle and column. The work-spindle unit at the end of the arm is made in two parts built together. One part pivots horizontally between the two sides of the arm and can be rotated to any position between straight up or straight down. The other part can be rotated on it, in a plane parallel to the pivot axis, through a complete circle. The design provides for means to make all these adjustments without difficulty and for location of operating controls that are convenient to the operator.

Motor sizes respectively of 3, 5, 7½ and 10 hp. are recommended with speeds of 1,800 r.p.m. on the two smaller sizes and 1,200 r.p.m. on the others. Weights range between 5,000 and 30,000 pounds.

SHOP EQUIPMENT NEWS

Bartlett Hayward Plate Bending Machine

Being unable to obtain a stock machine that had sufficient capacity for the sheet bending operations incident to fabrication of its large waterless gas holders, the Bartlett Hayward Company, Baltimore, Md., has constructed one especially for the work. The machine will make square angle bends in 10 gage to ¼-in. sheet steel that show no deflection from a true straight line or variation in radius of the bend in the length capacity of the machine which is 31 ft. Three bends are made in each sheet, a 2½ to 3-in. flange being bent up at 90 deg. on the two long sides and then one side is again bent up at a line 10 to 12 in. from the first bend till the latter is again horizontal and a channel effect has been formed square with the body of the sheet. After flanging, measurements taken across the sheet show a width variation of less than 3/32 in. The machine is illustrated in Figs. 1 and 2 which show it respectively in the up and down positions.

Before going further it should be explained that the photographs were taken when the machine was first constructed and before the demand for larger gas holders made it necessary to increase the length by the addition of a seventh section. The fact that the machine could so be added to is an indication of constructive foresight on the part of the company's designers and engineers in building rigidly enough as to strength and in making provision for future increase in size to meet the product demand. The description makes reference to the machine as it stands at present with seven sections or yokes.

The line drawing, Fig. 3, is an end section taken through the machine. A heavily ribbed box-type table *A* is bolted and supported on feet which are integral with the main cast-steel yoke *B* of which there are seven, spaced a little over 5 ft. apart. The circular recess in this yoke is machined to guide and back up the cast-steel bending quadrant *C* which is rotated for the bending operation on the sheet *D* by gearing to the driving assembly and the 50-hp. motor *E*. Rotation somewhat beyond 90 deg. is available if necessary to compensate for any springback in the sheet. A replaceable wearing strip *F* is set into the quadrant to project a little above its surface and to localize the pressure close to the radius of the bend.

The steel clamping beam *G* is supported by pin-connected links *H* and *J* which are made of steel forgings and by the forged lever *K* which is keyed to the shaft *L* bearing in the

Fig. 3—An end-section diagram to illustrate the actions

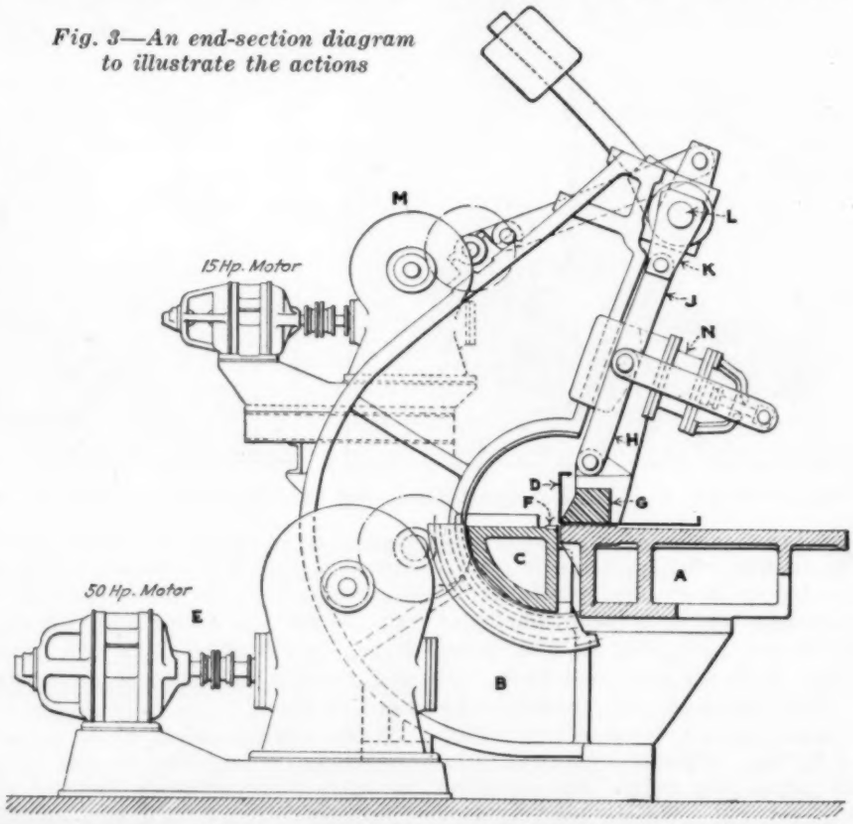


Fig. 1—Bartlett Hayward Plate Bending Machine.

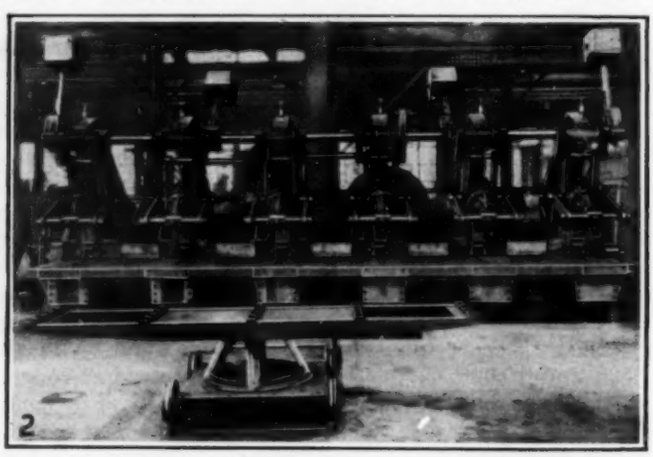


Fig. 2—A front view with hold-down clamp raised

SHOP EQUIPMENT NEWS

upper end of the yoke. An elevating mechanism *M* driven by a 15-hp. motor rotates this shaft for raising and lowering the beam, while counterweights neutralize the weight of the parts.

The links *H* and *J* together are longer than the straight-line distance from their pin connections in *G* and *K* when the beam is down in clamping position, although the line drawing Fig. 3 does not indicate this fact. Pressure is applied to the cylinder *N* to straight line these links. The resulting toggle action greatly increases the pressure on the clamping beam and takes up any lost motion between the points of pressure on the table and on the yoke bearings for *L*, and provides for varying thicknesses of the work for wear, and for ironing out any irregularities in the sheet.

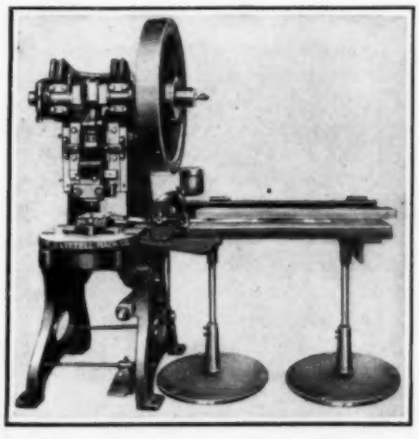
The cylinders are mounted to pull against ribs on the yoke and to travel on them as the clamp is raised and lowered.

Plates are handled with the help of an overhead crane and the revolving carriage on the track in front of the machine so that approximately 100 large size sheets can be completed per day.

The motors drive through Cleveland Worm Gear Co., reduction units and are provided with automatic protection and push-button control.

Littell Combination Stock Table and Oiler

The F. J. Littell Machine Co., 4125-2-T Ravenswood Avenue, Chicago, Ill., has perfected and is marketing the self-contained stock table and oiler illustrated. It is designed for adaptation to any press, vertical or inclinable, as it can itself be inclined and is provided with heavy bases which form its own independent support. These bases have sufficient weight so they need not be bolted to the floor, thus making the equipment portable to use at any press where it may be needed. The table can be made the length desired.



Littell Combination Stock Table and Oiler

The oiling attachment consists of a pair of rolls and an oil container to feed in regulated amounts and to retrieve the excess. The stock is oiled on both sides.

The rolls are said to save a good deal of the operator's time or that required for the method of brush oiling which the rollers replace.

Cleveland Armature Heavy-Duty Buffers and Polishers

A line of buffing and polishing machines has been designed and put on the market by the Cleveland Armature Works, 4732 St. Clair Ave., Cleveland, Ohio. There are two types both intended for general-purpose heavy-duty service.

The type illustrated in Fig. 1 is a variable-speed two spindle machine

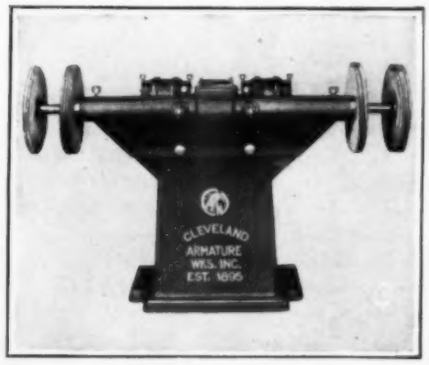


Fig. 1—Cleveland Armature Double-Spindle Heavy-Duty Buffer and Polisher

which consists essentially of two single-end units mounted on a common base but each with its own driving motor. The motors are designed to bolt against a central housing back of the spindles into which their shafts project to carry hardened steel sprockets for chain drive. They are mounted with reference to the

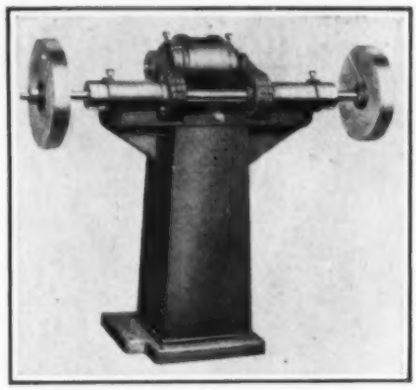


Fig. 2—The single-spindle type

housing so they can be moved back to compensate for chain wear.

The housing is oil tight and contains lubricant which is splashed on the chains and sprockets continuously. The spindle housings are integral with the base and support the chrome-nickel spindles on Timken adjustable bearings. Shaft locks are provided to assist in placing and removing the wheels. The two halves of the machine are independent of each other and are started by controls at the front connecting to compensators mounted on the rear of the column. Alternating current motors of either 60 or 25 cycle are provided to specification on which the compensator can be set by the operator to speeds of 2,300; 2,600; 2,900 and 3,100 r.p.m. for the 60-cycle current and 2,300, 2,600, 2,800 and 3,100 r.p.m. when 25-cycle current is available. Other speeds are available to special specifications.

The machine is made in four standard sizes of varying overall spindle lengths of 48, 58, 60 and 78-in. and weigh from 1,500 to 2,000 lb. The motors range from 2 to 6 hp. per spindle.

The machine illustrated in Fig. 2 is built for one double-ended spindle and is driven by a single motor which is V-belt connected at both ends of its shaft. These V-belts are in reality chains which are leather faced and are designed to a capacity of one hp. per section. On the machine illustrated there are four, two on each side of the motor.

This type is made in two sizes of 48 and 60-in. spindle lengths and in 2, 4, 6 and 7½ hp. for 60 and 25 cycle current. They weight from 1,200 to 1,500 lb. Speeds of 2,200; 2,500 and 2,800 r.p.m. are available by moving the motor control.

SHOP EQUIPMENT NEWS

Bilton Automatic Milling Machine

The Bilton Machine Tool Co., Bridgeport, Conn., has bought out a new cam-operated, station-type milling machine that embodies many of the principles of the Bilton Automatic Gear Miller and is adaptable to the milling of a large variety of work; including screw-slotting, keyways and oilgrooves on external work, milling square or hexagon heads, milling flats on round pieces for spotting setscrews, cutting slots at 90 deg. or other angle simultaneously, and for many other small jobs of like nature.

The cutter spindle, with overarm, splash guards and driving pulley, is a complete unit which is attached by T-head bolts to a vertical slide, that has a movement of 1 in., operated by a lever that derives its movement from a cam shaft at the rear of the machine. It is roughly adjustable with relation to the slide by means of the attaching bolts, and the vertical position of the slide to which it is attached is minutely adjustable by a micrometer-graduated screw in the end of the operating- or "cut"-lever; thus permitting accurate settings for depth of cut.

The vertical slide takes its bearing in the forward end of a ram that has a maximum horizontal movement of 4 in., also derived from a cam on the main camshaft. Both of the above mentioned cams are easily removable, without dismounting the shaft, and are interchangeable with others to secure varying relations between the vertical and horizontal movements.

The spindle has tapered journals adjustable to compensate for wear; and is carbonized, hardened and ground. It runs in cast-iron bearings. A No. 3 Morse taper hole accommodates the shank of the cutter arbor. The overarm is a part of the unit and supports the outer end of the arbor.

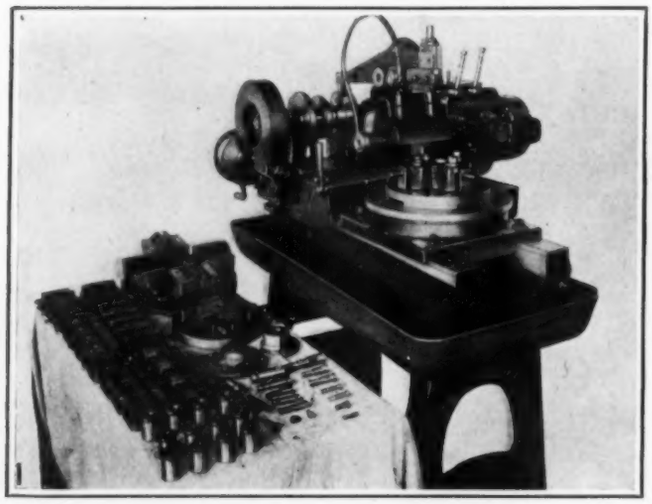
The spindle drive is by a double belt to a flanged pulley, mounted on a stud in the ram and traveling with it. A pinion on the hub meshes with an intermediate gear, and that in turn with a gear that is keyed to the spindle. The intermediate gear is located at the joint of a pair of compensating levers, so that the vertical slide moves up and down with relation to the ram without affecting the center distances of the gears.

The camshaft is driven by a separate belt, through worm reduction gearing. The wormwheel is of bronze and the worm of steel. These parts are made with single thread, two, three or five starts, according to the nature of the work to be done, and are interchangeable.

The cam-roll of the ram is on a bracket that is adjustable lengthwise of the ram so that the cutters may be positioned with respect to the work.

The circular work-table is mounted upon a slide on the base of the machine and has a range of movement of 5¾ in. in a direction parallel to that of the ram. The table is not, however, gibbed to the slide, but is held down by four bolts and has no movement during the operation of the machine. This adjustment is provided solely for the purpose of locating the work with respect to the cutters.

The rotary table has an automatic indexing movement, one step at each cycle of the machine, and is positively locked in each position. Ordinarily the table moves through 90 deg. at each cycle, but this may be changed to any lesser angle as the work may require. The indexing movement is derived through levers below the bed from the main camshaft.



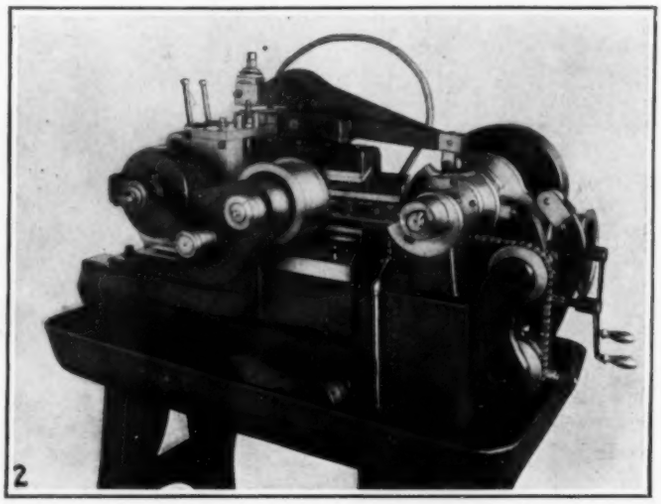


Fig. 1—Bilton Automatic Milling Machine. Fig. 2—Showing the cams, levers and driving mechanism

Special fixtures, readily attachable to the rotary table, are required to hold the work. With the table set to make four stops to each revolution and two sets of cutters on the arbor it is easily possible to make two cuts at right angles simultaneously. By increasing the number of stops to six and using three pairs of cutters, a complete hexagon may be milled and a finished piece taken from the fixture at every stop after the fifth. The machine runs continuously and the operator has but to unload and reload at the idle station at the front of the table.

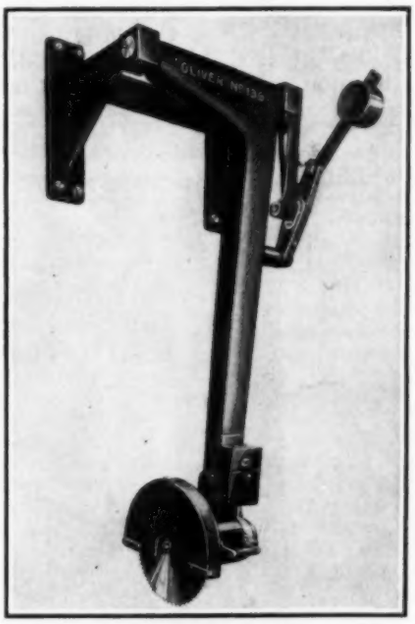
The machine is made in but one size. It weighs 2,000 lb. and occupies a floor space which measures 26 in. in width by 50 in. long.

To the left of the machine in Fig. 1 is illustrated an array of fixtures used for various purposes.

SHOP EQUIPMENT NEWS

"Oliver" High Production Swing Saw No. 136

A swing saw on which the driving motor is built integral with the saw arbor at the bottom of the swinging arm has been added by the Oliver Machinery Company, 1015 Clancy Ave., Grand Rapids, Mich., to its other products. It is designed from the standpoints of ease of operation, a minimum number of parts, adaptability to suspension from wall or ceiling and safety for the operator.



Oliver High Production Swing Saw No. 136

The motor housing has a solid extension which fits with a tongue and groove into the main frame to allow 2 in. of vertical adjustment so saws can be reduced 4 in. in diameter, from their size when new. The end housings which are interchangeable are made of cast aluminum and carry dustproof radial ball bearings. Alemite lubrication is used.

The saw arbor on which the rotor is mounted carries two saw collars 4 in. in diameter and is itself 1 in. in diameter where the saw is applied.

The hanger bracket has a 37-in. machined base and is so designed that it can be secured to the wall to project out a sufficient distance or to suspend the frame from the ceiling as may be desired. The counter balance is arranged to resist the movements of the saw by a minimum amount and yet to return it to a swung-back position when the operator releases the handle. A safety switch is mounted on the frame just above the motor.

The standard size saw is 16 in. in diameter but an 18-in. saw may be used. The former will cut 12-in. planks 3½ in. thick, while the latter increases the thickness capacity to 4½ in. The approximate distance from saw arbor to bracket when hung from the ceiling is 7 ft. and 6 in. which decreases to 6 ft. and 7 in. when the machine is attached to a wall.

The equipment regularly includes, with the saw, the safety switch, semicircular guard, and 16-in. saw. An extra aluminum front-guard can be furnished to specification. The weight is 800 lb. when crated.

"Ohio" Universal and Tool Grinder No. 2-L

The Oesterlein Machine Co., Cincinnati, Ohio, has added the machine illustrated to its other lines. It is being marketed particularly for use in railroad and automobile shops for grinding gang reamers, boring bars, bridge reamers, taps and similar tools. The company has featured the design from the standpoint of rapid manipulation and wide range of application.

The machine has a capacity of 30 in. between centers, a 9-in. swing, a 7½-in. vertical travel, and is constructed for the application of attachments for cylindrical, internal and surface grinding in addition to its regular set-up for tool and cutter work.

The company has adopted a number of design features of its milling machines in the construction of the grinder particularly as applying to the table movements and controls.

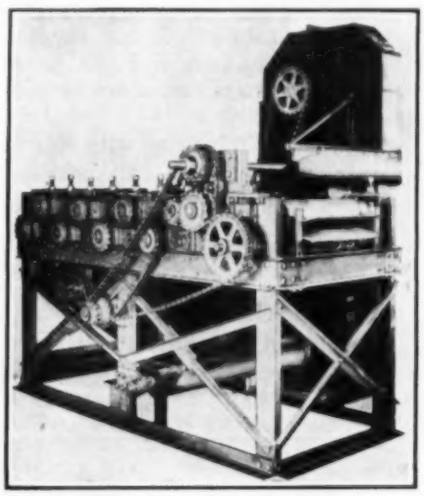
Oesterlein Ohio Universal and Tool Grinder No. 2-L

A handwheel and an independent ball-bearing lever are provided for the table longitudinal movements to be used as the operator may desire. The lever can be engaged at any point to enable the operator to make use of it most conveniently. The company has added this lever to its standard No. 2 and No. 3 grinders also.

Broden Strip Steel Cleaning Machine

A machine designed to replace the slow hand process of cleaning dirt and oil from strip steel before annealing is being built and marketed by the Broden Construction Co., 1265 E. 55th St., Cleveland, Ohio.

Feed rolls move the strip through the machine between a series of buffing rolls which rotate at different speeds. At the same time chaff is fed down on the strip to absorb the oil. The buffing rolls pick this chaff up as it passes through with the strip and drop it to a hopper. A screw conveyor and bucket elevator convey it back again to its point of feed.



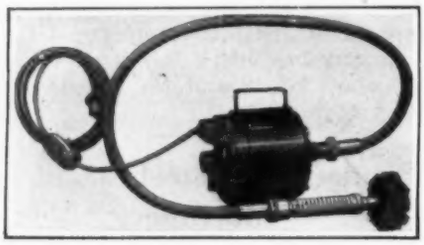
Broden Strip Steel Cleaning Machine

The buffing rolls are 6 in. in diameter and are faced with cotton. Chains on each side drive alternate rolls, one side operating at 100 r.p.m. and the other driving at 150 r.p.m., the difference in speed improving the polishing effect on the steel.

SHOP EQUIPMENT NEWS

C. L. P. Flexible Shaft Motor

A flexible shaft motor of the portable, heavy-duty type has been brought out by the C. L. P. Electric Co., 50 Vesey St., New York, N. Y. As illustrated, the outfit is readily portable and is useful for reaching



C. L. P. flexible shaft motor

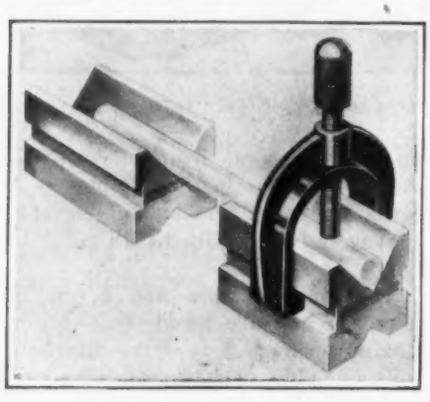
awkward corners and confined spaces to clean, grind or buff. It is also useful in scratching, vulcanizing, sanding and for removing paint and rust

Equipment includes the motor which is of ¼ hp., 4 ft. of flexible shaft, 10 ft. of lamp cord with plug and switch, and a scratch brush. Motors can be supplied for alternating or direct current and of speeds from 1750 to 3500 r.p.m., according to requirements. Drill chucks, grinding wheels, rotary files and sanding drums can be supplied as extra equipment. Larger sizes can be built to order.

The hand grip is fitted with Norma adjustable, open-type ball bearings to avoid possible overheating.

Brown & Sharpe V-Blocks and Clamp No. 749

The Brown & Sharpe Manufacturing Co., Providence, R. I., has added a set of V-blocks and clamp to its line of small tools for general machinist's use.



Brown & Sharpe V-Blocks and Clamp No. 749

The blocks are made of cast iron and are intended for holding a circular piece, of length within reason and up to 1½ in. in diameter, to steady and locate it for drilling, milling, grinding or marking and laying out. The clamp which holds in the square slots cut in the side of the block can be screwed against the piece to hold it square with reference to the end of the block and to keep it from rotating.

Each block is 2-in. long by 1½-in. square, and is being marketed in sets of two blocks and one clamp.

Barker-State Universal Gear-Drive Saw

The saw illustrated has been added by R. L. Barker & Co., to their other lines of portable electric machines. It is designed for the general-purpose work to which this type of saw is adaptable, for cutting wood,

Barker-State Universal Gear-Drive Saw

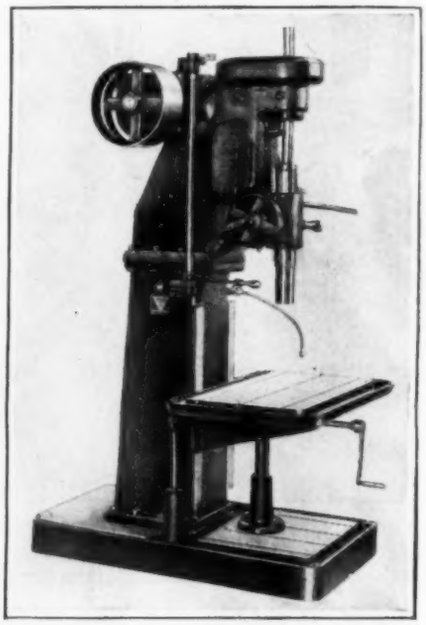
metals, bakelite, and similar compositions.

The working unit of the machine which includes the ball-bearings saw spindle connected to the motor drive by helical gears, and a ½-hp. motor can be adjusted vertically by means of a handwheel conveniently located. The table is hinged on the pedestal and is sufficiently large to handle stock 12 in. in width. The machine is a complete unit in itself and can be operated upon connection to a source of current.

The saw is 8 in. in diameter, will cut a maximum depth of 2⅜ in. The table is 23x28 in. and stands 34 in. in height. The weight is 300 pounds.

Barnes Drill Co. Clutch-Pulley Drive for No. 210 Drill

A pulley drive has been developed by the Barnes Drill Company, 830 Chestnut St., Rockford, Ill., for use



Barnes Drill Co. Clutch-Pulley Drive for No. 201 Drill

in connection with its No. 210 drill which was described on page 712, Vol. 61 of the *American Machinist*.

The assembly is mounted on top of the machine and includes the company's multiple-disk clutch which operates in connection with the automatic tapping reverse for both direct and reverse rotation.

A vertical shaft illustrated in place on the column is controlled by a conveniently adjustable handlever to actuate the clutch. Further provision is made to stop rotation the instant this clutch is disengaged by installing an automatic brake on the hub of the driving gear.

Other features of the machine including the six-splined spindle and special points of design have been previously described as stated.

News of the Week

Patent Office Is Transferred to the Department of Commerce

Hoover outlines changes contemplated regarding patentees

Under the authority of the Act establishing the Department of Commerce, the President signed an Executive Order transferring the Bureau of Patents from the Department of the Interior to the Department of Commerce.

This transfer was recommended by the Secretary of the Interior, Hubert Work, and the Secretary of Commerce, Herbert Hoover. It was recommended among other changes in federal organization, by the joint Congressional committee on reoganization.

The better organization of the Federal Government to secure economy and efficiency requires that functions of similar major purpose shall be grouped together. The Patent Office is a scientific bureau for aid directly to industry and commerce. Its nearest relations in the government are the Bureau of Standards and the Bureau of Foreign and Domestic Commerce, now in the Department of Commerce.

No changes are contemplated in the personnel of the bureau. Secretary Hoover stated:

"In incorporating the Patent Office in the Department of Commerce I intend that we should undertake a vigorous campaign for the removal of the present injustices toward American patentees and American manufacturers that exist by virtue of the character of patent laws in many other countries.

"At the present time an American patentee is required in many foreign countries to continuously manufacture in that country under his patent or lose his patent rights. We make no such requirement in the United States. The consequence is that our inventors and manufacturers in order to protect their inventions have been driven to the establishment of a large number of factories abroad, whereas foreign patentees have been able to use their patents in the United States to actually prevent manufacture here.

MANUFACTURING ABROAD

"A list of many large manufacturers established by American capital abroad in order to protect their patents could be enumerated whereas there has been no establishment of manufacture in this country for this reason. In fact, a foreign patentee, by registering his patent in the United States, can hold it for 17 years and prevent manufacture of the article in the United States.

"This is but one of the discriminations now in progress. There is to be an International Convention for the Protection of Industrial Property, at the Hague, on Oct. 8, 1925, at which the American government is to be represented and where proposals will be made for the equitable and equal treatment of patentees in all countries. If this convention shall fail to secure primary justice for American patentees, we shall ask for a complete revision of the patent laws of the United States that will bring this about.

"Moreover, other burdens put upon American patentees in foreign countries discourage the American inventor from registering his patents and securing the rights that should naturally come to him from his invention, while we give every facility in the United States.

"We shall propose nothing but equality in these questions and we intend to follow up the matter with utmost vigor.

"Four years ago the Patent Office was 15 months behind in its work—that is, it was 15 months after the receipt of an application before that application could be considered. Under support given by Congress, and the fine administration of Secretary Work and Commissioner Robinson, this period has been reduced to seven months. It is my hope that further support and continued vigorous administration of the Bureau will bring the Bureau up to date in its work within the next year or two."

Arbitration Discussed in New York

A conference was held at the home of Mr. and Mrs. Vincent Astor, New York, on March 19, at which the progress of commercial arbitration was discussed from many angles. Mrs. Astor presided. Herbert Hoover was unable to attend, but sent a representative who told of some of the work accomplished by the Department of Commerce along this line.

Willis H. Booth, president of the International Chamber of Commerce outlined the work being done to settle commercial differences between firms in different countries in Europe. William C. Redfield spoke of arbitration work that had been done between transportation companies and shippers, which was afterward borne out by a railway representative who told how legal litigation had practically disappeared in such cases.

Senator Thos. J. Walsh came up from Washington to give aid to the project, urging that the arbitration laws be given a fair trial and pointing out certain phases that must be given careful attention. "All states," he said, "must enact similar laws in order to secure the best results." Chas. L. Bernheimer, chairman of the Arbitration Committee of the Chamber of Commerce, who with Judge Moses H. Grossman did much to inaugurate the movement, spoke on the New Federal Arbitration Law. He pointed out that an agreement to arbitrate, unless backed up by legal sanction might easily prove a delusion.

Others who spoke were Frank H. Sommer, Justice Raymond MacNeille, Will H. Hays, Thos. B. Paton, Julius Cohen and others directly interested in the work of arbitration in various industries. The speakers showed to what a large extent arbitration had been adopted in such industries as shoes, spices and motion pictures.

G. A. Gray Co. Building New Plant

The G. A. Gray Co. has begun the erection of a new plant of the monitor type with wood-block flooring at Woodburn Ave. and the Pennsylvania R.R., Cincinnati. It is to be 420 ft. long by 210 ft. wide and is to have three spur tracks inside of the shop.

The main bay will be 60 ft. wide with a clearance of 25 ft. 6 in. under the crane. The secondary bay will be 50 ft. wide with a clearance of 19 ft. under the crane.

Running at right angles to the main shop will be a bay 40 ft. wide and 100 ft. long with 16 ft. under the crane. The cranes will consist of two of 20, one of 15 and three of 3-ton capacity.

The building is being erected on a 6½-acre plot and it is expected that the new plant will be in operation early in the fall.

Decrease Noted in the Cost of Living

The index number of the National Industrial Conference Board for February, 1925, indicates a decrease in the cost of living of one and one-tenth per cent between Jan. 15 and Feb. 15, 1925. This was due to decreases in the average retail prices of food, amounting to two per cent; clothing, one and two-tenths per cent; and shelter, five-tenths of one per cent. The average cost of the other items included in the total cost of living remained unchanged durthis period.

Business Improves in France

The influence of politics on business—French machinery exports—Machine tools selling better—Minor labor troubles—Rumors of Ford factory near Paris

By Our Paris Correspondent

FRENCH political, financial and tax matters, to say nothing of the proposed revision of the customs tariff on four hundred items, taken apart shows a situation that still rests on the one fundamental of industrial production and distribution so far as the general prosperity of the country is concerned.

The matter of high prices for the consumer is one that will not down with unequally distributed taxation whereby the manufacturer as well as the paid industrial worker, are carrying the load that a certain radical deputy has said ought to be shifted in part upon the agriculturists. More than ever these two elements take opposed views of the situation.

In the matter of tariff reform the proposed upward revision on four hundred items will hit the American manufacturers seriously, particularly those in the various metal trades.

Monsieur Loucheur, a former minister of commerce, who is interested in many big industrial enterprises, is urging the country at large to increase production and exports. Though of the opposition he has generously praised many of the policies of Monsieur Herriot as has also Marcel Cachin, the communist deputy, who says that Monsieur Herriot is valiantly sustaining unheard-of violence in the attacks that are being made upon his government by the conservatives.

Monsieur Loucheur's idea is that increased exports should be the chief means of bringing back the franc to more nearly a gold standard. Obviously this is so, but he is not counting on the supreme effort that Germany is soon to make in world markets and of which the effects are already being felt.

Increase in Exports

Final figures of French exports of "tools and metal manufactures" in 1924 show that they reached the amount of 1,940,000,000 francs paper. In value this is an increase of 20 per cent over the figures of 1923 but in tonnage—the only real base for comparative estimates—they showed a falling off of 20,000 metric tons.

French machinery exports in 1924 were chiefly to Belgium-Luxembourg (57,463 metric tons) and Germany (11,652 tons). From the latter country were imported 3,525 tons, not including 29,068 tons from the Saare. These partical figures by no means represent the general status, but the complete 1924 tabulations are not yet available.

Tool steel was exported to the extent of 256 tons to Belgium-Luxembourg, 132 tons to Indo-China, 116 tons to Germany and 95 tons to Italy. Imports were 951 tons from the Saare and 618 tons from Great Britain.

The foundry situation is in a particularly favorable light, even with respect to malleable. Bolts and nuts are being put out by certain specialist firms far in excess of the power of the market to absorb at this time.

Competition in files is very keen and new and old line producers all claim to have gratifying orders in hand. The Swiss, in the past, and to some extent at the present time, have had a considerable share of this business in France.

Machine Tools in Demand

Screw manufacturers are seemingly satisfied with an average business and nothing abnormal is noted here. In general producers are holding to lists and regular discounts.

Electrically welded chains have been largely called for recently by French railways for various needs, and orders have readily found takers among French manufacturers who in this branch are at all events little affected by German competition.

Sales of machine tools are reported satisfactory among French makers. This is said to be a result of the falling franc of the past two or three weeks. What is probably meant is that a further fall will bring about increased prices and those in need of tools or machinery at this time are taking advantage of the situation and laying in for their needs. French tool manufacturers undoubtedly took benefit of the low price of steel and components of the first nine months of 1924 and actually produced on a scale in excess of immediate market consumption, the terms being especially favorable. Carrying heavy stocks they have been able to meet spot orders, in most instances advantageously for all concerned and even to meet prices induced by quantity production makers abroad. The "satisfactory" condition of the market may be considered, however, merely as momentary.

There is still preoccupation in certain circles as to the advisability of the placing of big railway rolling stock orders in Germany. The project of the P.L.M. and the Nord railways is for 50,000,000 francs worth of material, comprising 3,000 gondola and box cars of twenty tons capacity and 1,000 platform cars of forty tons capacity.

A Lyons firm has received an order for fifteen electric "auto-motor" standard gage cars for a mountain branch of the Paris, Lyons and Mediterranean Railway. Other French makers are bidding for orders for 115 freight cars from the Roumanian state railways.

There have been some minor labor troubles since the first of the year, but of no great moment. The branch Schneider plant at Cherbourg has been affected and the Simon agricultural machinery factory has had trouble. In spite of the employers' ready granting of an increase all round of 1 franc, 60 centimes per day to workers the proposition was rejected by the workers who demanded a round 5 francs a day increase.

Italian metal workers in the Turin and Milan districts are demanding an increase for all adult labor of 2 lire per day. At Naples 2,000 workers in the metal trades are out on strike for the same reason of wage increase, a demand that is sustained by the perfectoral authorities backed by the Mussolini government.

There is also some unrest in Belgium where the matter may assume larger proportions.

It is believed that these indications are of a concerted movement on the part of union labor in various contiguous countries, thus giving the affair a political complexion, if such it can be called from the American point of reasoning.

The sensation of the week has come from the automobile trade. It is said that Mr. Ford has acquired a vast extent of ground in a Paris suburb for the erection of a plant that will produce a "French Ford" (doubtless also tractors) conceived after the taste of the French buyer. To compete with Citröen it will be necessary to produce a lower powered, smaller car, and one of a manifestly reduced gasoline consumption.

The plot actually envisaged is said to be that belonging to a large celluloid manufacturing concern that proposes to move away from the Paris district. If this is true it comes singularly close on the heels of the Citröen project to build a supplementary factory away from Paris near Grenoble, where doubtless for cheap power and the possibility of a less volatile class of labor conditions will be better met than in suburban Paris. There are two schools of thought in this respect. Give the worker a chance to amuse himself in or near a great city and you will always have a supply of labor. Put your factory in a country community and you may be able to recruit a less exigent class of labor.

Unemployment Decreases

The Department of Labor states that reports in February indicate that the industrial employment conditions of the country are on an upward trend and on a par with expectations for this period of the year. This has produced the belief that unemployment will steadily decrease in every section of the country as the year progresses. During the latter part of February there was a decided increase in the demand for all classes of skilled labor.

Hudson Explains Aims and Work of the Division of Simplified Practice

Tells of the elimination of waste in many industries

"Wasted time, materials, power, and a hundred-and-one other forms of waste account for most of our business failures," declared Ray M. Hudson, chief of the Division of Simplified Practice, United States Department of Commerce, at a luncheon of the Cosmopolitan Club, Peoria, Ill., March 25. "It is estimated that our annual waste of materials alone would, if utilized, support nearly 1,000,000 persons on a high standard of comfort. In all probability this estimate is too conservative. It has also been said that whole nations of other people could live on what we waste. With allowances for understatement on one side and exaggeration on the other, the actual waste we tolerate is appalling."

"The annual waste by fire, which averages five hundred million dollars a year," Mr. Hudson continued, "has aroused many organizations to the promotion of fire prevention education. But this loss, huge as it may seem is less than one-twentieth of the loss in industry through waste."

Illustrating his talk with lantern slides, Mr. Hudson reviewed the investigations made by the Hoover Committee of 18 prominent industrial engineers which revealed an average waste in six typical American industries of nearly 50 per cent.

Fully $10,000,000,000 can be saved annually, Mr. Hudson declared, by the broader application of simplification and standardization. This sum, the speaker pointed out, is equal to half of the valuation of all the railroads in the United States; and is also equal to more than half the net income of the people of the United States as shown by income tax returns of 1922.

Explaining Simplification

There is a difference between standardization and simplification, he explained. The development of standards is a long process that seeks the embodiment of the best thought and practice, and the effect of standardization is best exemplified in such standardization as the gage of our railroads, the dimensions of electric lamp bases, and other items entering into daily life. In the automotive industry, Mr. Hudson pointed out, it is estimated that the cars produced by the auto manufacturers of this country would cost fully 20 to 25 per cent more but for the progress made in standardizing cars.

The American Society of Mechanical Engineers has reported more than a thousand opportunities still existing in items like machine shop tools and equipment.

American industries, said Mr. Hudson, are finding a shorter means of reducing waste. The method is based on a commonsense test—a study of the variety of items produced by an industry, an analysis of the demands for the varieties, and a pruning of the "dead wood" that saps the strength of the remainder. This simplification is more or less common among successful business men, but there is at times a hesitancy to make such cuts because of the fear that others may not do so and may thereby gain some business. It was to help whole industries undertake such studies and make the reductions co-operatively that Mr. Hoover, when he became Secretary of Commerce, established the Division of Simplified Practice. The Division, that has no police powers nor inquisitorial authority, acts as a clearing house to cooperate with manufacturers, distributors and consumers in first getting the facts about variety and demand, in making an analysis to determine where the "dead wood" of excessive or obsolete variety is, and in presenting for the joint action of all three factors of the industry a program for their acceptance on a basis that will be to the best interest of all.

Joint action is an assurance to all three that there is nothing being "put over," the speaker said, and enables the buyer to use his influence in bringing about and supporting the economies resulting from simplification.

Pay Due Bethlehem War Workers

The War Department is expediting in all ways possible the necessary preliminaries looking to the payment of $1,600,000 in back pay due 21,000 machine shop workers and 8,000 others who were in the service of the Bethlehem Steel Co. between Aug. 1, 1918, and Feb. 28, 1919.

This payment covers increases in wages allowed by the War Labor Board. The award in this case was made under the impression that all of the work being done at the Bethlehem plant was on a cost-plus basis. This assumption, in the main, was incorrect and the Labor Board requested the War and Navy Departments and the other government agencies that had contracts with the Bethlehem company, to adjust them on such a basis as to offset the wage increases which had been ordered.

Before the classification of the machine shops and other workers, except the electricians, could be completed the Judge Advocate General of the Army rendered an opinion that the additional payments to cover the wage increases could not be made legally. The company already had paid $100,000 in additional wages to 1,000 electrical workers. The appropriation just voted provides for the repayment of that $100,000 as well.

Army Orders Planes of New Design

The Army Air Service, which has been seeking a more manoeuvrable and safer type of airplane for general observation use, and to replace the war-built D. H.'s, awarded contracts totaling more than $1,100,000 for eighty-five new planes to the Curtiss Co. of New York and the Douglass Co. of California.

Ten were ordered from the Curtiss Co. at an estimated cost of $250,000, and seventy-five, at an estimated cost of $883,000, from the Douglass Co.

At the same time the War Department announced that it has awarded $70,000 to the Curtiss Co. and $60,000 to the Douglass Co. for the experimental observation planes of these new types as manufactured by each of them and for the development work involved in their production.

Export Managers in Annual Meeting

Saunders Norvell, chairman of the board of McKesson & Robbins, and E. B. Filsinger, export manager of Lawrence & Co., were the principal speakers at the dinner at the Hotel Pennsylvania, New York, following the "annual get-together" meeting of the export Managers' Club of New York, Inc., on March 24. Mr. Norvell spoke on "Export Trade and Domestic Problems," and Mr. Filsinger on the "Export Manager's Place in Modern Business."

At the morning session at which W. R. Cummings, vice-president in charge of sales of the Monroe Calculating Machine Co., presided, there were the following speakers: Address of welcome, A. Schoonmaker, president of the Export Managers Club and export manager of the Bourne-Fuller Co.; "Market Analysis as an Export Sales Force," Louis A. C. de la Garde, the General Motors Export Co.; "Building Sales Through Known Facts," Loren Emery, assistant general merchandising manager, the International General Electric Co., Inc., and "The Export Sales Representative," W. L. Bomer, export manager, the Bristol-Myers Co.

Oren O. Gallup, export manager of the Simonds Saw & Steel Co., presided at the afternoon session at which J. A. Zellers, foreign sales manager of the Remington Typewriter Co., spoke on "Co-operation with Foreign Distributor or Dealer," and A. B. Dod, export manager and export credit manager of Merck & Co., spoke on "Handling Export Credits to Create Sales." A round table discussion which proved to be most interesting and constructive concluded the meeting.

Freight Loading Shows Increase

Loading of revenue freight for the week ended on March 7 exceeded the corresponding weeks in all previous years on record, according to reports for the week filed by the carriers with the Car Service Division of the American Railway Association. The total for the week was 930,009 cars. This exceeded by 628 cars, the corresponding week last year and by 24,665 cars the corresponding week in 1923. It also exceeded by a wide margin the corresponding weeks in 1920, 1921 and 1922.

The Business Barometer

This week's outlook in Commerce, Finance, Agriculture and Industry based on current developments

By Theodore H. Price
Editor, *Commerce and Finance, New York*

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THOSE who recall the views expressed in these letters since the year commenced will realize that the writer has not been in sympathy with the post election boom on the Stock Exchange. He has felt that cheap money was its only basis and that a lasting improvement in trade, which means an increased distribution of goods, could not be expected while the cost of living was mounting day by day as commodity prices advanced.

Recent developments have vindicated this view, but as the markets never move uninterruptedly in one direction it may be that we shall soon see a substantial recovery from the decline in stocks and grain that was recorded last week.

That decline, long overdue, was precipitated by the predicament of the Chicago, Milwaukee & St. Paul R.R. and the collapse of the thoughtless speculation in the wheat market whose overbought condition had long been evident to everyone but those who were the victims of their own enthusiasm.

Now that a receiver for the railroad has been appointed and wheat has declined more than 50 cents a bushel the worst of the shock ought to be over, although it would be against precedent to assume that a buying movement that has lasted five or six months could be liquidated in a fortnight.

It is, moreover, undeniable that many thoughtful holders of railroad securities have been somewhat disturbed by the *apologia* for the receivership that the St. Paul directors have given out. They attribute the railroad's inability to pay interest on its bonds to:

1. The competition of the Panama Canal for the trans-continental and far Eastern traffic of which the railroads previously had a monopoly.
2. The agricultural depression of the last few years in the Northwest.
3. The increase in taxes and cost of labor and material.
4. The competition of motor vehicles, largely as result of which the St. Paul's revenue from passenger traffic fell from $31,034,000 in 1920 to $21,768,000 in 1924.

Since all of these are factors with which the other transcontinental railways have to contend and since no railroad can hope to long escape the adverse reflex of agricultural depression, increased costs and taxes, or the competition of the automobile, it is not surprising that a secondary consequence of the St. Paul receivership was a decline in some of the railway shares that have been so buoyant of late.

It is now recalled that the Boston & Maine recently applied for permission to tear up 1,000 miles of its line, offering to substitute an automobile service for the trains that it is now running and that some other important railroads are already using motor trucks to transport some of the short haul freight that they formerly carried by rail.

So it may be that St. Paul's embarrassment will mark the end of the boom in railway securities, for it is plain that not even the alchemy of consolidation can long avail against automobiles that reduce gross earnings and the rising costs and taxes that take what's left.

The fight between the President and the Senate is another incident that has somewhat cooled the enthusiasm of the erstwhile bulls in the stock market. Its significance is probably exaggerated, but it has demonstrated that a few radicals hold the balance of power in the Senate and confidence in Mr. Coolidge's ability to put over his policies is slightly diminished.

Iron and steel are somewhat lower. Ever since Henry Ford bought some Belgian rails for his railroad the market for steel in the Eastern States has been held in check by the fear that the foreigners would undersell the American mills and, although the quantity actually imported is small, it has been large enough to give buyers the whip hand in their negotiations. Copper has fallen to 14¼ cents and the other non-ferrous metals are lower.

The truth seems to be that there is a distinct reduction in the new building planned. Last week a curtailment in the East but an increase in the West was reported, but it is now asserted that much of the new construction that was being arranged for in the West will be held up because of the decline in grain.

The lassitude that has overtaken business has perhaps been increased by the fatalities and losses caused by the tornado in the Middle West, the great fire at Tokio and the flood that has destroyed the Peruvian city of Trujillo. But these happenings, though deplorable, would not have had much effect if the temper of business had been as optimistic as it was two months ago.

The physical facts are as they were but the psychology of the public has changed and until hope and confidence are again in the ascendant every one will be telling his fellows to "watch your step."

In Europe a feeling of hesitancy is also developing. Under the leadership of John Maynard Keynes, England's resumption of specie payment is being strenuously opposed and France is considering the unlimited increase of her paper money by the issuance of a "check currency" to tax payers who will buy it at a discount. If the proposal is adopted a further decline in the gold value of the franc would seem to be unavoidable.

What's Doing in Industry

Business in the machinery and machine tool industries in all parts of the country slackened a trifle last week for no apparent reason. With March showing a better average thus far in the month than either January or February and with no disturbing factors appearing on the surface, the dearth of actual orders has been received with surprise by builders and dealers. Inquiries, however, have kept up to their normal pace, which, by all the rules of the industry, means a steady trend in April.

Railroad buying was not as active after the fifteenth of the month. Southern railroads bought single tools, the C. & O. bought on a small order and there was some purchasing by Southwestern roads, but none of the buying was of more than passing interest.

Hope is held out that the automotive interests will be in the market within the next two weeks. Production figures from the motor car centers would indicate further increases in automobile, truck and bus production, which in turn will mean that newer machine tools will be needed. The more popular makes of cars are showing bigger increases than the less known, and closed models are making steady gains in favor.

Builders of presses are reported as extremely busy in most parts of the country. In addition to the usual demand for presses there has come an added demand from radio receiving set builders for small presses which has sent this branch of the industry to a greater output.

Used tools are reported as finding a fairly good market.

Exporters are busy both because this time of the year is always the best for overseas sales and because exporting has grown and continues to grow in favor for certain types of machines that are unobtainable in European countries.

The Industrial Review

Progress of the machinery and machine-tool business in various parts of the country

THE following reports gathered from the various machinery and machine tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

New England

Manufacturing for export is of such a volume that machinery builders in the New England territory, particularly those in Connecticut, sum up their present business, by such terms as, "our export business is the best we have had in five years," "we have a fine foreign business" or "it seems to us that our business with continental European countries is picking up substantially." Ten men, speaking for important industries, were interviewed and five of them brought up the matter of their European business without suggestion. Two of the others who were asked about the foreign business said they had slightly better than the normal amount of foreign orders. These manufacturers said that their general business is also ahead of that of a year ago.

From a half a dozen different sources figures on employment were obtained and these show that in the particular plants the working forces have been increased 550 in two weeks. On a basis of man-hours the improvement in March over February is approximately 5 per cent.

Good buying for railroads continues and sizeable orders from the automotive industry have been received. Most of this buying is judged to be of the replacement variety.

As the end of the first quarter of the year approaches sales managers are beginning to study their tables and draw conclusions. Special efforts are being directed to close sales on business pending. Those who have ventured guesses place the improvement in business at 20 to 30 per cent over the previous quarter and 7 per cent over the corresponding period a year ago.

Canada

Unusual interest in Canadian machine tool dealers is being shown by the Ford Motor Co. of Canada, in the purchase of equipment for its Australian plant. Although little Canadian-made machinery has been purchased on account of the limitations of Canadian plants in the automatic field, an order for four lathes has been secured by a firm in Galt, Ontario, and the remainder of the machine tools needed, although of American manufacture, is being purchased through Canadian dealers.

Industrial conditions generally continue to show a steady upward trend. In the Hamilton district an increased demand for machinists and skilled mechanics of all kinds is reported. Word is received from Gananoque, Ontario, that the plants of the Ontario Steel Products Co. are now operating to capacity on advance orders for spring delivery, far ahead of the corresponding period a year ago.

Orders from automobile manufacturers are exceptionally good, and a very active demand is reported for axles.

One of the most gratifying developments in the industrial situation at present is the marked improvement occurring in the farm implement industry. The leading companies all expect to do much better this year than last. Construction awards during February totaled $11,000,000, an increase of $2,000,000 over January, and indications are that there will be a steady expansion in construction during the remainder of the year.

Detroit

More orders were recorded for machinery and machine tools in the Detroit and Michigan territory last week than during the previous week and dealers reported that the volume of inquiry was steadily increasing. Due to the gains made by the automotive industry during the first part of March and the favorable outlook for the remaining days of the month as well as the good prospects for April, machine tools have been in a greater demand and the future is expected to yield still further improvement.

There has been an increase in the demand for electrical tools and reports are to the effect that last week will probably prove to have been the best experienced so far this year.

Used tool dealers state that business is steady although it is far from the earlier expectations and not much immediate improvement is anticipated.

The employment figures show that there are now employed 25,000 more people than at the first of the year. This is due to increased activity in the automotive field and its auxiliary trades, and also the fact that January is inventory time for many industrial plants when employment is at a low ebb.

Buffalo

For the first time in many months there is a pessimistic note revealed in the discussion of business with many of the machine tool people of Buffalo. Just what it means will probably be revealed by the condition of business two weeks hence.

With a few it was difficult to determine whether the slight depression was real or fancied, but with others the belief was quite pronounced that the business had actually slipped considerably during the last two weeks.

The most that a résumé of the situation can show at present is that the machine tool and allied businesses are not up to expectations. In the face of the pessimism there were two or three who reported conditions in their lines to be good and prospects better.

The demand for road machinery is still brisk and promises to continue. There is little or no interest in cranes and heavy tool equipment, although some orders have been placed for small equipment. There are three grain elevator jobs in Buffalo running into a construction total of several millions of dollars, but it is believed that the equipment orders for these elevators will go to Chicago firms where the general contracts were let.

One dealer reported that one or two of the smaller steel companies in Buffalo are curtailing activities, presumably due to a lack of orders or a sufficient volume of business in sight. It is interesting to note in this connection, however, that both of the companies referred to have been, up to this time, working to a capacity not previously realized since the war-time activities.

One manufacturer stated that there had been good sales of regular shop equipment since the first of January, but that there had been little demand for special equipment. He also reported a slowing up of business beginning with March 1, but did not attach very much importance to it.

Cincinnati

Machine tool manufacturers and machinery dealers describe business as being wave-like in its nature, with alternate rises and falls. It is stated however, that the business sea is getting smoother, and therefore it is easier to make progress in the matter of increasing sales. There is some disappointment that the predicted and expected increase in demand for machine tools has not materialized, but all remain hopeful and none are discouraged.

Those who went to the recent Chicago show came back greatly encouraged, as the attendance and the interest shown indicate that there are many who intend to buy in the near future. Railroad representatives, it is stated, were particularly interested, and it is thought that the railroads will do considerable buying in the near future. The Chesapeake & Ohio R.R. is said to have sent out inquiries on a big list of tools. No small amount of hope is based on the fact that freight car loadings reported are above the record of the same period of the previous year, the increase for the first nine weeks being 5.4 per cent.

One leading manufacturer stated that while domestic business is not yet what it should be he is by no means discouraged and is confident that the demand will increase as spring advances. Another concern stated that it has ceased to wait for inquiries to come in and has adopted the policy of sending men out to find people who are in the market and make sales.

Still another manufacturer expressed the opinion that there has been too

much concentration on production, with the result that the selling end of the machine tool business has been neglected. The market is now somewhat overstocked, it is asserted, and the only remedy for this is the use of intensive selling methods.

Chicago

Indications that the machine tool industry has started on the up grade, even though slowly, are becoming more evident as spring approaches. Interviews with executives and sales managers representing machinery interests disclose a much more optimistic feeling than has prevailed of late. This is due partly to increased sales and inquiries, and partly to expansion of industrial operations.

In a report just issued by the general advisory board of the Illinois Department of Labor, in which factory conditions throughout Illinois are reviewed, it is shown that more than 4,000 factory workers have been put back to work within the last 30 days, making a total increase of 31,000 in three months. The report further states that small factories are springing up in the small cities and villages all over the state.

As heretofore, the metal industry leads the advance, the largest gains being among manufacturers of automobiles and accessories, agricultural implement and car manufacturing plants coming next. A summary shows that the gains in iron and steel, machinery, agricultural implements, and instruments and appliances amounted to between 2 and 3 per cent. Small as this gain may appear, it clearly indicates the upward trend of production, and its heartening effect upon machinery and machine tool men is perceptible by the tenor of the remarks one hears when talking over the situation with those engaged in these lines of business. The first half of March shows a slight improvement over the same period in 1924.

New York

Buying by general industrials in small lots, inquiries from the railroads and electrical companies, and a brisk demand for presses were the features of the machinery and machine tool markets in New York City last week. One of the press builders located near New York City is running at close to capacity with no let-up in sight.

The Chesapeake & Ohio R.R. was in the market for some tools and the Lackawanna is reported ready to close on several of the items on the list recently put out. Buying to some extent has been done by Southern roads, but none of the purchasing has been for more than one or two articles.

While the week in New York was fairly active and there was some business closed, the week was by no means up to recent business. No reason is given for the sudden let-down and dealers are inclined to believe that it is a temporary lull rather than an indication that a decline has set in.

Used machine tools were in fair demand with some sales reported to New England textile manufacturers and traction companies in Pennsylvania.

Personals

W. C. DAVIS has been elected president of the Foote Bros. Gear & Machine Co., Chicago. J. T. Kerwin was elected vice-president and treasurer and A. W. Foote secretary. The following were re-elected to the board of directors: J. T. Kerwin, W. C. Davis, A. W. Foote, Thomas J. Harper, Leo J. Doyle, Ralph M. Shaw and E. J. Robinson.

T. B. CRAM has charge of the new department of Drying Systems, Inc., Chicago. This department will be devoted to the design and manufacture of industrial furnaces, oil, gas and electrical types.

G. BLUEMEL is the engineer in the new industrial furnace department of Drying Systems, Inc., Chicago, Ill.

A. A. PAOLI, formerly sales engineer of the Canadian Ingersoll-Rand Co., Sydney, N. S., has been appointed manager of the company's office at Winnipeg.

ERNST KRAUSE of the firm Ernst Krause & Co. AG., XX/2 Engerthstrasse, 151, Vienna, Austria, will sail March 28 for Europe. He has been in this country on business for several weeks.

H. B. KRAUT of the Giddings & Lewis Machine Tool Co., Fond du Lac, Wis., has been vice-president, general manager and a director since May, 1924. Through error, an announcement was made in the *American Machinist*, Vol. 62, p. 370f, in which the impression was conveyed that Mr. Kraut had recently joined the Giddings & Lewis company.

C. M. ROBERTSON has resigned as vice-president of the Dale Machinery Co., Chicago. Mr. Robertson was for many years general superintendent of the Colburn Machine Tool Co., going to Chicago as its representative 17 years ago. He later became associated with the Dale Machinery Co., becoming Chicago sales manager when that company was absorbed by the Consolidated Machine Tool Co. and later vice-president of the present Dale Machinery Co. Mr. Robertson will announce his plans for the future later.

GLEN RIEGEL, for several years metallurgical engineer of the Gerlinger Steel Casting Co., West Allis, Milwaukee, has been appointed works manager. ALBERT M. WEIS, who has been foreman of electric furnaces, has been appointed foundry superintendent.

JOSEPH M. MERROW has been re-elected president of the Merrow Machine Co., Hartford, Conn.

FRED W. RAMSEY has resigned as president of the Cleveland Metal Products Co., Cleveland, Ohio.

RICHARD HEALD of the Heald Machine Co., Worcester, Mass., sailed from New York March 25 for an extended business trip abroad. He will study business conditions in England and the countries on the continent returning in about five months.

W. S. RACE has joined the Miller-Hurst Corporation, foundry and industrial engineer. Mr. Race was formerly with the United States Rubber Co., having worked in the New York and Detroit Offices.

R. H. SCRIBNER has been elected a director of the Cleveland Automatic Machine Co., Cleveland, Ohio.

Business Items

Botwinik Brothers, New Haven, Conn., have purchased the plant of the New Haven Carriage Co. on Water St. and will move shortly all of their warehouses and machine shops so that the company will be all at one address. This will include the main office and warehouse at 21 Sylvan Ave., the machine shop at 92 Orchard St., the State St. motor department, the Bridgeport warehouse, and several other smaller units.

The W. J. Westaway Co., Hamilton, Ont. has been appointed district representative for the Farrel Foundry & Machine Co., Buffalo, and will cover the Eastern half of the province of Ontario.

The Fitzgerald Manufacturing Co., Torrington, Conn., metal manufacturer, has re-elected the following officers for the ensuing year: P. J. Fitzgerald, president; M. F. Fitzgerald, treasurer; B. G. Peck, secretary.

Fire of undetermined origin destroyed the plant of the Union Seamless Tube Co., at Bellvue, Ohio, recently with a loss of $40,000.

The Ansonia Foundry Co., formerly of Ansonia, Conn., has acquired the plant of the Bridgeport Iron & Metal Co., recently bankrupt, on Howard Ave., Bridgeport.

Wilson-Brown Inc., 2 Rector St., New York City, has been appointed selling agent for eastern New York by the Universal Boring Machine Co., Hudson, Mass.

Obituaries

HARRY E. VAN TINE died suddenly at his home in New York City. Mr. Van Tine had been prominently identified with the automobile industry for the past twenty-five years. He developed the Clement-Bayard car and previous to that had been with the Singer Manufacturing Co., Elizabeth, N. J. At the time of his death he was engaged in the perfection of a Diesel engine.

HERBERT HANTON UPSON, aged 52 years, died at his home in Thomaston, Conn. He was for thirty-seven years connected with the Waterbury Manufacturing Co., and the Chase Metal Works, more recently as assistant treasurer and credit manager of the Chase companies.

Calendar of Local Meetings

American Society of Mechanical Engineers

Boston, Mass. March 26. Visit to new Weymouth station of the Edison Electric Illuminating Co. M. K. Bryon, secretary, 201 Devonshire St. Boston, Mass.

San Francisco, Calif. March 26. Local Meeting. E. C. Hutchinson, "Hydraulic Machinery." F. Birdsall, secretary, the Bethlehem Shipbuilding Corporation, San Francisco, Calif.

Indianapolis, Ind. March 27. Joint debate between engineering students of Rose Polytechnic Institute and Purdue University. "Resolved that the United States Should Favor the Building of a Great Lakes-St. Lawrence Waterway in Co-operation with Canada." R. H. Bennett, secretary, Industrial Sales Co., 315 Guaranty Building, Indianapolis, Ind.

Colorado. March 27. Metropole Hotel, Denver, Col. Local meeting. Charles Erwin "Shop Production Methods in the Burlington Shops of Denver." William Lester, secretary, Vulcan Iron Works, Denver, Col.

New York. March 31. Engineers Societies Building, 29 West 39th St., New York. Power and Fuel Meeting. "Unit System of Burning Pulverized Coal." Fred J. Bechert, secretary, 350 Madison Ave., New York City.

Akron, Ohio. March 31. Engineering Building, University of Akron. Local Meeting. E. G. Bailey, "Instruments of Measurement." Prof. F. D. Clark, secretary, University of Akron, Akron, Ohio.

Utica, N. Y. April 2. Local meeting. "The World Power Conference," Calvin W. Rice. B. E. White, secretary, 222 Genesee St., Utica, N. Y.

Allentown, Pa. April 3. Local Meeting. "Storage and Handling of Coal." H. E. Broughton, secretary, the Trojan Powder Co., Allentown, Pa.

Columbus, Ohio. April 3. Local meeting. "The Engineering Profession—Its Antiquity and Its Obligations," Dr. William F. Durand. Arthur Richards, secretary, Chillicothe, Ohio.

Cleveland. April 6. Local Meeting. Dr. W. F. Durand, "The Engineering Profession — Its Antiquities and Obligations." C. D. Zimmerman, secretary, the Cleveland Electric Illuminating Co. E. 70th St. Station, Cleveland.

Hartford, Conn. April 7. Joint meeting with the American Society for Steel Treating. H. W. Schwartz, "Present State of Art of Malleable Iron." C. W. Mayott, secretary, the Hartford Electric Light Co., 266 Pearl St., Hartford, Conn.

New Haven, Conn. April 7. Local meeting at Mason Laboratory. "Development of Belt Conveyors," C. K. Baldwin. Prof. S. W. Dudley, secretary, 400 Temple St., New Haven, Conn.

Toronto, Canada. April 8. Local meeting at the University of Toronto. "Present Tendencies of Steam Generation," J. O. Twinborro. H. C. Crane, secretary, 50 Simpson Ave., Toronto, Can.

Baltimore, Md. April 8. Local meeting. "Development of the Aeroplane Engine." Commander Wilson. Prof. J. C. Smallwood, secretary, Johns Hopkins University, Baltimore, Md.

Chicago. April 8. Local meeting at the Western Society of Engineers. "Material Handling." F. B. Orr, secretary, the Illinois Maintenance Co., 1136 Edison Building, Chicago.

New York City. April 9. Local meeting of petroleum division. Subject and speaker to be announced later. Fred J. Bechert, secretary, 350 Madison Ave., New York City.

Buffalo. April 14. Local meeting. M. S. Schneider, "Material Handling." C. G. Kaelin, secretary, 635 Genesee St., Buffalo, N. Y.

Milwaukee, Wis. April 15. Local meeting at the Milwaukee Athletic Club. "Co-operation between State University and Industry." Robert Cramer, secretary, 1105 Vliet St., Milwaukee, Wis.

San Francisco, Calif. April 16. Local meeting. "Engineering and Finance," Guy Emerson. F. Birdsall, secretary, the Bethlehem Shipbuilding Corporation, Ltd., San Francisco, Calif.

Bellingham, Wash. April 17. Local meeting. "Portland Cement Grinding," Mr. Krobbe. R. L. Rockwell, secretary, 955 Empire Building, Seattle, Wash.

Salt Lake City, Utah. April 18. Local meeting. "Training of Industrial Foremen." W. H. Trask, Jr., secretary, University Club, Salt Lake City, Utah.

State College, Pa. April 18. Local meeting "Power Plants for Air Craft," Lieut. Commander E. E. Wilson; "Management," Wallace Clark. Prof. L. J. Bradford, secretary, Pennsylvania State College, State College, Pa.

Portland, Ore. June 22 to 25. Pacific Coast Regional Meeting.

American Society for Steel Treating

Schenectady, N. Y. Spring Section Meeting. May 28, 29 and 30. Hotel Van Curler. W. H. Eisenman, secretary, 4600 Prospect Ave., Cleveland, Ohio.

National Association of Cost Accountants

Chicago Chapter. April 9. Annual Banquet. "Figuring Costs of Distribution."

Worcester Chapter. April 9. "Costs for Managerial Uses."

Philadelphia Chapter. April 10. W. H. Jackson, "Cost as an Aid to Management."

Milwaukee Chapter. April 14. W. K. Adams, "What Information Does the Bank Want."

Cleveland Chapter. April 15. "Problems of Distribution" and "Figuring the Costs of Distribution."

Rochester Chapter. April 15. M. J. Hayes, "In What Manner Do We Give Information to Foremen?" "How We Use Cost Information that is Given Us."

Syracuse Chapter. April 15. James E. Halligan, "Budgets in Franklin Management."

Buffalo Chapter. Aril 16. "What Information Does the Banker Want," and "Preparing Cost Data for Managerial Control."

American Welding Society

Cleveland, March 27. Application of welding in general repair and construction work. Stanley Crute, the Advance Welding Co.

Chicago. April 3. C. E. Zeisel, "Applications of Welding and Cutting."

Buffalo. April 15. S. L. Walworth, "Cutting and Welding by Carbon Arc."

Boston. April 17. Prof. V. O. Homerburg and C. E. Littlefield.

Philadelphia. April 20. S. W. Miller, "Welding Pressure Vessels."

Cleveland, April 21. Interesting welding jobs. Mr. Boom of Boom Boiler & Welding Co.

Trade Catalogs

Power Drill. The Buffalo Forge Co., Buffalo, N. Y. A two-page mailer has been issued in which the Buffalo 20-in. backgeared upright drill is described. Eight features are listed with an illustration of the drill, and there are specifications given.

Roller Bearings. The Bond Foundry & Machine Co., Manheim, Pa. Tables showing the load capacity and other interesting data for the various styles of commercial roller bearings made by this company are given in the booklet. Illustrations show the products and short descriptions set forth the merits.

Fans and Blowers. The American Blower Co., Detroit, Mich. The fans and blowers made by this company and trade named "Sirocco" are shown and described in Bulletin No. 1801 that has been mailed out. Many tables of specifications and several sectional drawings are contained in the bulletin.

Small Motors. The Century Electric Co., St. Louis, Mo. The Century repulsion start induction motors that are made by this company with the wool yarn system of lubrication are shown in a four-page folder. The motors described are fractional hp. motors and eight advantages of this system are enumerated.

Chucks. The Terkelsen Machine Co., Boston, Mass. Greater strength and more gripping power are emphasized in a compact folder that has been issued. Sectional drawings show the exclusive features of the Terkelsen chuck. A table of dimensions and a price list are also to be found in the folder.

Sand Blasting Machines. The United States Silica Co., Chicago. The many uses of the "Flint Shot" in a variety of factories and foundries are shown by illustration and text in this booklet. Ease of operation and low cost are stressed together with the greater efficiency of the machine.

Welding Electrodes. The General Electric Co., Merchandise Department, Bridgeport, Conn. Arc stability, ease of manipulation, flexibility of operation, rapid deposition and good penetration, and maximum economy are some of the headings used in describing the product to which this booklet is given over. Some illustrations show work that has been done and also work in the process of being welded.

Brass Products. The Bridgeport Brass Co., Bridgeport, Conn. The data book of this company has been mailed out to customers and contains much valuable information that is needed in industrial plants. Tables of weights and other information are given.

Export Opportunities

The Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., has inquiries for the agencies of machinery and machine tools. Any information desired regarding these opportunities can be secured from the above address by referring to the number following each item.

Drilling machines. Bombay, India. Purchase. Reference No. 14,093.

Iron and woodworking machinery. Leghorn, Italy. Agency. Reference No. 14,076.

Pumps and rams. Nairobi, Africa. Agency. Reference No. 14,077.

Woodworking machinery, rod and dowell machines. Melbourne, Australia. Purchase. Reference No. 14,088.

Forthcoming Meetings

American Welding Society. Annual Meeting. April 22, 23 and 24. Engineering Societies Building, 29 West 39th St., New York City.

National Metal Trades Association. Twenty-seventh annual convention. Hotel Cleveland, Cleveland, Ohio, April 22. J. E. Nyhan, national secretary, Peoples Gas Building, Chicago, Ill.

The National Supply and Machinery Distributors' Association. Twentieth annual convention, Ambassador Hotel, Atlantic City, April 27, 28 and 29. George A. Fernley, secretary and treasurer, 505 Arch St., Philadelphia, Pa.

Southern Supply & Machinery Dealers' Association and the American Supply & Machinery Manufacturers Association. Joint Convention. The Atlanta-Biltmore Hotel, Atlanta, Ga., May 5, 6 and 7. F. D. Mitchell, secretary-treasurer, 1819 Broadway, New York City.

The Society of Industrial Engineers. National Convention. Hotel Winton, Cleveland, Ohio, May 6, 7 and 8. Executive secretary, George C. Dent, 608 S. Dearborn St., Chicago, Ill.

American Gear Manufacturers' Association. Ninth annual convention, May 6, 7 8 and 9. The William Penn Hotel, Pittsburgh, Pa. T. W. Owen secretary, 2443 Prospect Ave., Cleveland, Ohio.

American Society of Mechanical Engineers. Spring Meeting. Milwaukee, Wis. May 18, 19, 20 and 21. Calvin W. Rice, secretary, 29 West 39th St., New York City.

Society of Automotive Engineers. Summer Meeting. Greenbrier Hotel, White Sulphur Springs, W. Va., June 16, 17, 18 and 19. C. F. Clarkson, secretary, 29 West 39th St., New York City.

American Society for Testing Materials. Twenty-eighth annual meeting. Chalfonte-Haddon Hall Hotel, Atlantic City, N. J., June 22, 23, 24, 25 and 26. C. L. Warwick, secretary-treasurer, 1315 Spruce St., Philadelphia, Pa.

National Foreign Trade Council. Annual Convention. Seattle, Wash., June 24, 25 and 26. O. K. Davis, secretary, India House, Hanover Square, New York City.

New Haven Branch of the American Society of Mechanical Engineers. Fifth annual machine tool exhibition. Sept. 8 to 11. Mason Laboratory. H. R. Westcott, chairman.

American Society for Steel Treating. Annual Convention and National Steel Exposition. Public Auditorium, Cleveland, Ohio. Week of Sept. 14. W. H. Eisenman, Secretary, 4600 Prospect Ave., Cleveland, Ohio.

The Weekly Price Guide

Rise and Fall of the Market

Iron and Steel—Pig iron output slowing down; prices less firm. Market slow in scrap and semi-finished steel. Finished steel prices appear to be definitely headed in a downward direction. Bars are firm at $2.10 per 100 lb., Pittsburgh, but plates and shapes are reported to have gone below the $2 minimum of a week ago. The maximum quotation of $2.20 per 100 lb. on heavy rolled products is not holding. Steel sheets are weaker as to price despite active demand for automotive use.

Non-Ferrous Metals—Recent decline in copper believed to have been checked. There is also less fluctuation in tin. Owing to possible shortage no abrupt decline is anticipated in zinc. Softness characterizes antimony market; lead is featureless.

(All prices as of March 20)

IRON AND STEEL

PIG IRON—Per gross ton, f.o.b.:

CINCINNATI	
No. 2 Southern	$26.05
Northern Basic	23.77
Southern Ohio No. 2	23.77
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	32.25
BIRMINGHAM	
No. 2 Foundry	22.00
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	24.76
Virginia No. 2	30.17
Basic	24.76
Grey Forge	23.75
CHICAGO	
No. 2 Foundry local	22.00
No. 2 Foundry, Southern (silicon 2.25@2.75)	28.01
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	23.77
Basic	23.77
Bessemer	23.77

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	4.75
Cleveland	4.75@5.00
Cincinnati	5.00@7.50
New York	5.00@5.50
Chicago	5.25@5.75

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots.

Blue Annealed	Pittsburgh Mill Base	New York	Cleveland	Chicago
No. 10	2.70	3.89	3.45	3.80
No. 12	2.80	3.94	3.50	3.85
No. 14	2.90	3.99	3.55	3.95
No. 16	3.10	4.09	3.65	4.15
Black				
Nos. 17 and 21	3.35@3.45	4.55	4.15	4.30
Nos. 22 and 24	3.40@3.50	4.60	4.20	4.35
Nos. 25 and 26	3.45@3.55	4.65	4.25	4.40
No. 28	3.50@3.60	4.75	4.35	4.50
Galvanized				
Nos. 10 and 11	3.65@3.75	4.75	....	4.50
Nos. 12 and 14	3.75@3.85	4.85	....	4.60
No. 16	3.90@4.00	5.00	....	....
Nos. 17 and 21	4.05@4.15	5.15	....	4.90
Nos. 22 and 24	4.20@4.30	5.30	3.00	5.05
No. 26	4.35@4.45	5.45	4.15	5.20
No. 28	4.65@4.75	5.75	5.45	5.50

WROUGHT PIPE (Welded)—Warehouse discounts are as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded	53%	39%	55½%	43½%	59½%	48%
3½ to 6 in. steel lap welded	48%	35%	53½%	40½%	56½%	45%

Malleable fittings: Classes B and C, banded, from New York stock sell at list plus 4%; class A, plus 23%. Cast iron, standard sizes, 36% off.

Size, Inches	List Price per Foot	Diameters Inches — External	Diameters Inches — Internal	Thickness Inches
1	$0.17	1.315	1.049	.133
1¼	.23	1.66	1.38	.14
1½	.27½	1.9	1.61	.145
2	.37	2.375	2.067	.154
2½	.58½	2.875	2.469	.203
3	.76½	3.5	3.068	.216
3½	.92	4.0	3.548	.226
4	1.09	4.5	4.026	.237
4½	1.27	5.0	4.506	.247
5	1.48	5.563	5.047	.258
6	1.92	6.625	6.065	.28

SEAMLESS STEEL TUBING—Following base discounts are on 20 gauge or .035-in., round, cold-drawn tubing, ¼-in. to 1-in., O.D., weighing 0.17 lb. to 0.36 lb. per ft. Cutting charge per 100 cuts, $1.50 to $1.58:

O.D. Inches	List Price per ft.	Differential Discount	O.D. Inches	List Price per ft.	Differential Discount
¼	$0.09	50%	⅞	$0.16	35%
⅜	.11	45%	1	.18	31%
½	.14	40%			

NOTE—The discounts are to be lowered by the following differentials in the case of regular .10-.20 carbon: 25,000 ft. or over, 83; 15,000 to 25,000 ft., 82; 5,000 to 15,000 ft., 81; 1,000 to 5,000 ft., 80; less than 1,000 ft., 79.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	4.50	6.00	4.20
Spring steel (light) (base)	7.00	6.00	6.00
Coppered Bessemer rods (base)	6.85	8.00	7.20
Hoop steel	4.49	3.85	4.15
Cold rolled strip steel	7.00	8.25	7.85
Floor plates	5.55	4.60	5.50
Cold drawn shafting or screw	4.15	4.00	3.80
Cold drawn flats, squares	4.65	4.50	4.30
Structural shapes (base)	3.34	3.20	3.10
Soft steel bars (base)	3.24	3.10	3.00
Soft steel bar shapes (base)	3.24	3.11	3.00
Soft steel bands (base)	3.99	3.20	3.65
Tank plates (base)	3.34	3.42½	3.10
Bar iron (3.00@3.10 at mill)	3.24	3.21	3.00
Drill rod (from list)	60%	55%	50%

Electric welding wire, New York, 3/32, 8.35c.; 1/8, 7.85c.; 5/32 to 1/4, 7.35c. per lb. Chicago, 1/32, 8.85c.; 3/32, 7¼c.; 1/8, 7.95c. per lb.

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York	15.00@15.25		
Tin, 5-ton lots, New York	55.00@55.25		
Lead (up to carlots), St. Louis	8.60@8.65	New York	9.25
Zinc (up to carlots), St. Louis	7.30@7.35	New York	8.62½

	New York	Cleveland	Chicago
Antimony (Chinese), ton spot	17.00	17.75	....
Copper sheets, base	22.50	22.75	22.12½
Copper wire, base	20.12½	21.37½	20.75
Copper bars, base	21.75	23.25	22.62½
Copper tubing, base	24.75	25.37½	25.75
Brass sheets, base	19.12½	19.75	19.25
Brass tubing, base	23.75	25.50	25.00
Brass rods, base	17.12½	18.87½	18.37½
Brass wire, base	19.62½	20.75	20.25

Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Aluminium ingots, 98 to 99%, 1–15 ton lots	27.20	28.00	27.00
Zinc sheets (casks)	11.50	11.75	11.37
Solder (½ and ½), (case lots)	40.00	36.75	.....
Babbitt metal (83% tin)	60.00	65.50	50.00
Babbitt metal (35% tin)	28.00	21.50	28.00
Nickel (ingots) f.o.b. refinery	29.00	.....	.....
Nickel (electrolytic) f.o.b. refinery	33.00	.....	.....
Nickel (F shot) f.o.b. refinery	30.00	.....	.....

SPECIAL NICKEL AND ALLOYS—Price in cents per lb., f.o.b. Huntington, W. Va.:

Rolled nickel sheet (base)	52.00
Hot rolled rods, Grade "A" (base)	50.00
Cold drawn rods, Grade "A" (base)	58.00
Manganese nickel hot rolled rods "E"—low manganese (base)	54.00
Manganese nickel hot rolled rods "D"—high manganese (base)	57.00

Base price of monel metal in cents per lb., f.o.b. Huntington, W. Va.:

Shot	32.00	Hot rolled rods (base)	40.00
Blocks	32.00	Cold drawn rods (base)	48.00
Ingots	38.00	Hot rolled sheets (base)	42.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Crucible heavy copper	12.00@12.25	11.50	12.00
Copper, heavy, and wire	11.75@12.00	11.50	11.50@11.75
Copper, light, and bottoms	10.25@10.50	9.50	10.50
Heavy lead	7.50@7.75	7.00	8.00
Tea lead	6.50@6.75	4.50	6.75
Brass, heavy, yellow	7.25@7.50	7.50	8.00@8.25
Brass, heavy, red	9.25@9.50	9.50	9.75
Brass, light	6.25@6.75	6.25	6.75
No. 1 yellow rod turnings	7.75@8.00	7.25	8.00
Zinc	4.50@4.75	4.00	5.00

TIN PLATES—American Charcoal—Bright—Per box.

		New York	Cleveland	Chicago
"AAA" Grade:				
IC,	20x28, 112 sheets	$23.50	$22.85	$21.00
"A" Grade:				
IC,	20x28, 112 sheets	19.00	18.80	17.00
	Coke Plates—Primes, 20x28 in.			
100-lb.,	112 sheets	13.00	13.50	13.00
	Terne Plates—Small lots, 8-lb. Coating			
IC,	14x20	7.25	6.80@6.90	6.75

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.15@0.22	$0.19	$0.14@0.16
Cotton waste, colored, per lb.	.10@.15½	.18	.09½@.12¾
Wiping cloths, 13¼x13¼, per lb	.09½@.09¾	36.00 per M	.11
Wiping cloths, 13½x20½, per lb.	....	50.00 per M	.11
Sal soda, per 100 lb. keg	2.25	2.25	2.25
Roll sulphur, per 100 lb. keg	3.60	3.25	3.75
Linseed oil, per gal., 5 bbl. lots	1.14	1.32	1.25
Lard cutting oil, 25% lard, per gal.	.60	.50	.32
Machine lubricant, medium-bodied (50 gal. wooden bbl.), per gal.	.33	.35	.21
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, 24c. per lin. ft. per inch of width for single ply.			
Medium grade	40–2½%	30–10%	40–2½%
Heavy grade	30–5%	30%	38–5%
Rubber transmission, 6-in., 6 ply, $1.83 per lin. ft.			
First grade	50–5%	50–10%	60%
Second grade	50–10–5%	60–5%	65%

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.0324	$0.0324	$0.0354
Cold finished shafting	per lb.	.0415	.0415	.044
Brass rods	per lb	.1712½	.1762½	.16
Solder (½ and ½)	per lb.	.40	.42	.39
Cotton waste	per lb.	.15@.22	.15@.22	14@21
Washers, cast iron (¼ in.)	per 100 lb.	7.00	6.50	6.50
Emery, disks, cloth, No. 1, 6 in. dia.	per 100	3.38	3.38	3.38
Lard cutting oil	per gal.	.60	.60	.58
Machine oil	per gal.	.33	.29	.29
Belting, leather, medium	off list	40–2½%	40–2½%	40–2½%
Machine bolts up to 1x30 in.	off list	40%	45%	45%

MISCELLANEOUS—Continued

	New York	Cleveland	Chicago
Abrasive materials—In sheets 9x11 in., No. 1 grade, per ream of 480 sheets:			
Flint paper	$4.86	$5.84	.....
Emery paper	10.71	11.00	$11.90
Emery cloth	28.00	31.12	32.75
Emery disks, 6 in. dia., No. 1 grade, per 100:			
Paper	1.49	1.24	1.65
Cloth	3.38	2.67	3.55
Fire clay, per 100 lb. bag	.....	.65	.75
Coke, prompt furnace, Connellsville	per net ton		3.50@3.75
Coke, prompt foundry, Connellsville	per net ton		4.25@4.75
White lead, dry or in oil	100 lb. kegs		New York, 16.25
Red lead, dry	100 lb. kegs		New York, 16.25
Red lead, in oil	100 lb. kegs		New York, 17.75

SHOP SUPPLIES

Machine bolts, ¼x1½-in., per 100, $1.70. Discount at New York warehouses on all sizes up to 1x30-in., 40%; 1¼ and 1¼x3-in. up to 12-in., 15%; with cold punched hex. nuts up to 1-in. dia. (plus std. extra of 10%) 30%; with hot pressed hex. nuts up to 1x30-in. (plus std. extra of 10%) 35%. Machine bolts, up to 1x30-in., with cold punched and hot-pressed hex. nuts, also button head bolts with hex. nuts are $3.50 per 100 lb. at Cleveland. Tap bolts with hex. heads are $4.65 per 100 lb. at Chicago.

Carriage bolts, ¼x1½-in., per 100, $1.00. Discount on all sizes up to 1x30-in., 30%.

Coach and lag screws, 1½x$\frac{5}{16}$in., $2.25 per 100, less 40%.

Tap bolts, 1½x½-in., $1.00 per 100. List plus 35%.

Bolt ends, 1x12-in., 10c. per lb., less 40%.

Nuts, semi-finished, ½x¼-in., 2c. each. Discount 70% for $\frac{5}{16}$-in. and smaller and 65% for ⅜-in. and larger.
Case hardened ½x¼-in., 6c. each, less 50%.

Rivets, button heads, ¼-in., ⅜-in., 1-in. diam. x2$\frac{1}{16}$-in. to 4$\frac{1}{16}$-in., $5.00* per 100 lb. at New York warehouses; cone heads, same sizes, $5.20* per 100 lb. Rivets, $\frac{1}{16}$x1-in. and longer, 19c. per lb., less 50%. Same discount for tinned. EXTRA per 100 lb. for 1¼ to 2-in. long, all diameters, 25c.; ⅝-in. dia., 35c.; ½-in. dia., 75c.; 1-in. long and shorter, 75c., longer than 5-in., 50c.; less than 200 lb., 50c.; countersunk, heads, 45c.

Washers, cast iron, ⅜-in., $7.00* per 100 lb. at New York warehouses; ½-in., $6.00* per 100 lb.

*For immediate delivery from warehouse.

Machine Requirements and Industrial Construction

Machine Tools and Equipment Wanted

Ga., La Grange—La Grange Iron Works, R. J. Higginbothem, Secy.—gear cutters.

Mass., Arlington—I. J. Mitton, 28 Mystic Lake Drive—miller lathe and small drill.

Mass., Boston—Eli Miller, 198 Washington St.—power press, 1½ in. stroke.

Mass., Boston—J. M. Howe, 10 State St. —equipment for 6 story garage, near Bowdoin Sq.

Mass., Boston—School House Dept., City Hall—equipment for Roxbury Trade School addition, including metal and woodworking machinery.

Mass., Cambridge — Peter Gray & Sons, Inc., 286 Third St.—single action press.

Mass., East Boston (Boston P. O.)—A. Caponiglo, 442 Saratoga St.—miscellaneous tools and equipment for repair and service garage.

Mass., Lynn — Mattio Di Carlo, 78 Tremont St.—miscellaneous tools and equipment for repair and service garage at Tremont and Pleasant Sts.

Mass., Roxbury (Boston P. O.)—J. Silk, 2-4 Danforth St.—tools and miscellaneous equipment for repair garage.

Mass., South Boston (Boston P. O.)—Daniel Marr & Son Co., 384 Dorchester Ave.—equipment and miscellaneous tools for two story garage, on Old Colony Ave. and D St.

Mass., South Boston (Boston P. O.) — Keystone Mfg. Co., 288 A St.—large power presses.

Mass., West Roxbury (Boston P. O.)—W. J. Carlson, 18 Moreland St.—miscellaneous woodworking equipment for factory enlargement.

Mass., Worcester — L. G. Schafer, 42 Newberry St.—equipment and tools for repair garage.

Mich., Detroit—Fly Tight Screen Manufacturers, 1794 West Hancock Ave.—Equipment for making screens.

Mich., Detroit—Simonix Service & Sales Co., 477 Selden Ave.—medium size band saw and equipment.

N. J., Trenton Junction (Trenton P. O.) —State Board of Education—machinery for workshop for School for Deaf.

N. Y., Brooklyn — Neidich Mfg. Corp., 1450 Flushing Ave.—V. and O. No. 2 punch press.

N. Y., New York — Yorkville Pattern Wks., 315 East 97th St.—motor driven disc sander, 6-8 in. jointer.

O., Bucyrus—Bucyrus Lumber Co., A. S. Cunningham, Pur. Agt. — wood working equipment, including cutoff saws, molders, stickers, etc., for new interior finishing plant.

Okla., Oklahoma City — Boardway Co., North Maple St.—equipment for sheet metal working plant, including cranes, forges, welding equipment, etc.

Tex., Dallas—O. R. Meinholdt, 825 Ann Ave.—lathe, 16 in. swing, screw cutting.

Wis., Milwaukee—Snap-On Wrench Co., 1270 South Pierce St., Seidemann Pur. Agt.—3 automatic screw machines.

Wis., North Milwaukee — P. W. Anton Co., 1451 Murray Ave., Milwaukee—(packing boxes) resaw.

Wis., Oshkosh — R. McMiller Co., 633 High St.—woodworking machinery for sash and door factory addition.

N. S., Forest Home—K. P. Wood—rotary and stave saw and marker.

Ont., Burlington—A. Coates & Sons—single end tennoning machine with single or double cape.

Ont., Coldwater—D. Milligan, Joseph St. —equipment for stave mill, to replace fire loss.

Ont., Durham—Voker Bodies, Ltd., O. M. Voiles, Pres.—equipment for the manufacture of auto truck bodies.

Australia, Melbourne — Victorian Government Railway Board will receive bids until May 6 for supply and delivery of high speed turbine lathe and electric equipment; self contained, portable petrol engine driven electric welding plant complete with accessories; portable pneumatic outfit, with fittings.

N. Z., Auckland — Auckland Electric Power Board will receive bids until May 25, for furnishing electric crane, rotary converters and rotary balancer, etc.

Mex., Mexico City — R. E. Milan, 4a Chihuahua 84, Colonia Roma—can manufacturing machine 100 to 500 cans per day capacity.

Opportunities for Future Business

Calif., Los Angeles—Paraffine Companys Inc., 903 North Main St., manufacturers of asphalt products, insulating materials, boxes, etc., awarded contract for the construction of two 100x190 and 180x 360 ft. factory buildings, on Vernon Ave.

Calif., Oakland—Rip Van Winkle Wall Bed Co., 792 22nd St., plans the construction of a factory annex on recently purchased site at 22nd and West Sts. Estimated cost $40,000.

Calif., San Francisco—Schlage Lock Co., 485 California St., awarded contract for the construction of a 100 x 210 ft. factory at Bay Shore and San Bruno Aves., $45,000.

Ga., La Grange—La Grange Iron Works, R. J. Higginbothem, Pres., plans the construction of plant addition.

Md., Baltimore—Bd. of Awards, City Hall, will soon award contract for the construction of a repair shop for the fire department on Key St. between Highway and Webster Sts. Estimated cost $150,000. Private plans.

Mass., Boston—Jordan Marsh and Co., Washington St., awarded contract for the construction of an 8 story, 130 x 150 ft. garage on Beach St., between Washington St. and Harrison Ave. Estimated cost $500,000. Noted Oct. 30, 1924.

Mass., Boston—Kudish and Kager, 521 Seaver St., Roxbury, awarded contract for the construction of a 125 x 300 ft. garage building at 1246 Massacuhsetts Ave. here. Estimated cost $200,000. Noted March 12.

Mass., Gloucester — City, A. F. Grant, Clk. plans the construction of a repair and service garage, at School and Proctor Sts. Estimated cost $50,000. Architect not selected.

Mass., Jamaica Plain (Boston P. O.)—H. W. A. McPherson, 10 Roseway St. awarded contract for the construction of a 2 story 90x110 ft. repair and service garage, at 3708 Washington St. Estimated cost $75,000. Private plans.

Mass., Norfolk Downs (Boston P. O.)—S. H. Couch, Inc., 170 Purchase St., Boston, is receiving bids for the construction of a 1 and 2 story, 50 x 150 ft. manufacturing and storage plant, addition here. French and Hubbard 210 South St., Boston, Archts. Noted Feb. 5.

Mass., Springfield—Noyes-Buick Co., 857 Commonwealth Ave., Allston (Boston P.O.) is having plans prepared for the construction of a 2 story repair garage and service station at Main and Gardner Sts., here. Estimated cost $40,000. Private plans.

Mich., Detroit—Grover Co., 28 East Jefferson Ave. is having plans prepared for the construction of a factory for the manufacture of pneumatic tubes on Pine St. Estimated cost $50,000. Private plans.

Mich., Detroit—Hudson Motor Co., 12601 Jefferson Ave., awarded contract for the construction of a 3 story, 80 x 639 ft. building with 80 x 180 ft. wing, for assembly plant. Noted Mar. 5.

Mo., St. Louis—City, will build 2 story shops for manuel training departments of Bellefontaine Industrial Farm, by day labor. Estimated cost $50,000. L. R. Bowen & H. Updike, 301 City Hall, Archts. L. R. Bowen & C. C. Christo, 301 City Hall, engrs.

N. J., Trenton Junction, (Trenton P. O.) —State Board of Education, awarded contract for the construction of a 2 story, workshop, for State School for the Deaf. $57,998. Noted Oct. 9, 1924.

N. C., Durham—E. D. Bowling, et al., plan the construction of a factory for the manufacture of surefind drop wires, a cotton mill appliance. Estimated cost $100,000.

O., Cleveland—Cleveland Piston & Mfg. Co., 2301 Scranton Rd., awarded contract for the construction of a 60 x 84 ft. factory addition. Estimated cost $40,000.

O., Cleveland—Columbian Hardware Co., 5163 Hamilton Ave., H. F. Seymour, Pres., is receiving bids for the construction of a 2 story, 90 x 129 ft. factory on Hamilton Ave. Estimated cost $40,000. Private plans.

O., Cleveland — The Electric Controller and Mfg. Co., 2698 East 79th St., awarded contract for the construction of a factory addition. Estmated cost $40,000.

O., Cleveland—Pipe Machinery Co., 932 East 70th St., awarded contract for the construction of a 52 x 130 ft. factory on East 70th St. Estimated cost $40,000.

Okla., Oklahoma City — Boardway Co., North Maple St., is having preliminary plans prepared for the construction of a 60 x 88 ft. addition to sheet metal working department, including new machine shop. Estimated cost $60,000. H. S. Whitlock, Archt.

Pa., Harrisburg — Bd. of Directors of School Dist., D. D. Hammelbaugh, Secy., will receive bids until April 13 for the construction of a 2 story, 332 x 777 ft. school, including shop units, on Market St. Estimated cost $1,000,000. Manual training equipment will be required. E. Sibley, is the consulting architect.

Pa., Philadelphia—Carson & Carson, 22 South 15th St., Engrs. will soon award contract for the construction of a 60 x 202 ft. office and galvanizing shop at Tioga, Witte, and Sepviva Sts., for Cattee Bros. Corp. 1712 North 9th St.

Tex., Houston—J. H. Dore, 1203 Oak Dale St. is having plans prepared for the construction of a 75 x 200 ft. foundry. Estimated cost $42,000. Engineer not announced.

Tex., Paris—Paris and Mount Pleasant R.R. Co., N. H. Ragland, Secy. and Gen. Mgr., plans the construction of a roundhouse to replace fire loss. Estimated cost $150,000. Engineer not announced.

Wis., Milwaukee—E. W. Clark Motor Co., 456 Jackson St., had plans prepared for the construction of a 3 story, 95 x 120 ft. garage, on Ogden Ave. Estimated cost $150,000. Buemming & Guth, 521 Jackson St., Archts. Noted Nov. 6 .

Wis., Milwaukee—G. Zagel & Bro., 144 Oneida St., Archts. awarded contract for the construction of a 2 story, 62 x 115 ft. factory, on 30th St., for Builders Needs Inc., 1243 30th St. Noted March 19.

Wis., North Milwaukee—P. W. Anton Co., 1451 Murray Ave., Milwaukee (packing boxes), will build a 52 x 70 and 20 x 68 ft. factory on Custer Ave., here, by day labor. Private plans.

Ont., Coldwater—D. Milligan, Joseph St., plans the construction of a stave mill to replace fire loss. Estimated cost $18,000.